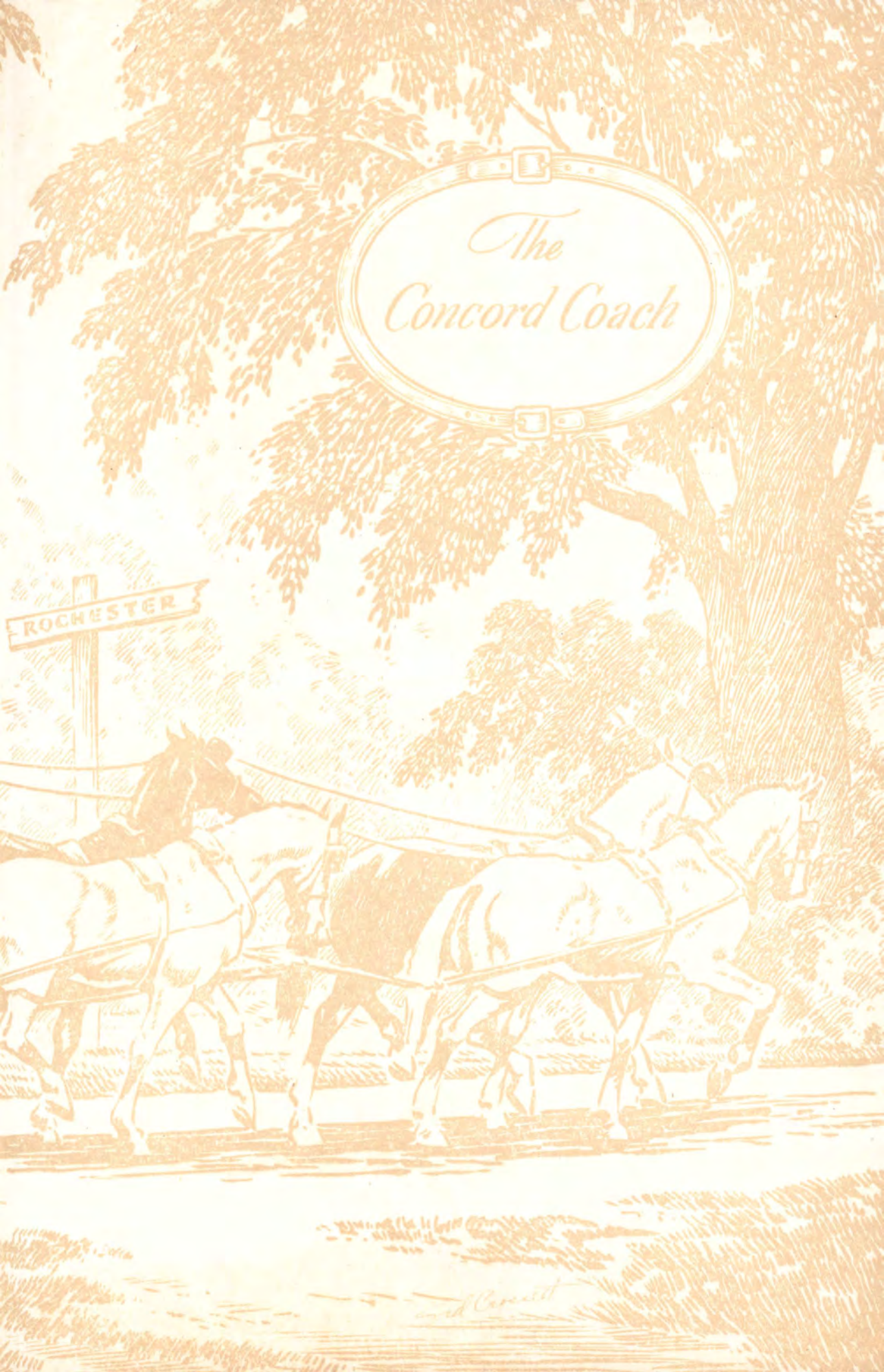
ONE HUNDRED TWENTY-FIVE YEARS IN THE PAPER BUSINESS

1819·1944




The
Concord Coach
ROCHESTER



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ONE HUNDRED TWENTY-FIVE YEARS IN THE PAPER BUSINESS

1819·1944

PRINTED IN
THE UNITED STATES OF AMERICA
1944

There is only one good reason for this book. In America a business life of 125 years is sufficiently unusual to warrant a moment's pause—and a backward glance—before looking ahead to the years that are to come. We therefore invite you to reminisce with us in these brief pages.

THE ALLING & CORY COMPANY

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In addition to the history of the Company, you will find in these pages a reprint of a booklet entitled "Paper, a Brief Account of How It Is Made." This booklet was written by Joseph T. Alling a number of years ago to provide an interesting and easily understood outline of the paper-making process. Brought up to date, it is included here for your information and entertainment.

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ONE HUNDRED TWENTY-FIVE YEARS IN THE PAPER BUSINESS

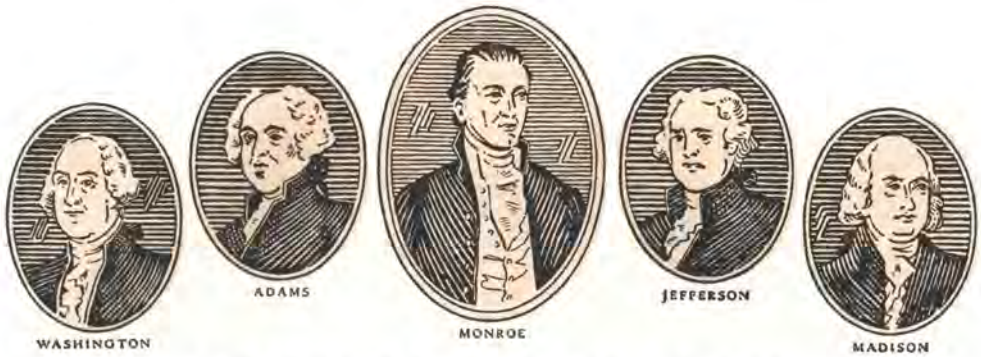
1819·1944

BEING A BRIEF HISTORY OF THE FOUNDING OF THE PAPER BUSINESS OF THE ALLING & CORY COMPANY, TOGETHER WITH AN ACCOUNT OF ITS GROWTH

DESIGNED AND PRINTED AT ROCHESTER, NEW YORK, IN THE MONTH OF MARCH, 1944, FOR THE ALLING & CORY COMPANY



FROM THIS SMALL STORE IN A COUNTRY VILLAGE HAS GROWN THE BUSINESS OF THE ALLING & CORY COMPANY, REQUIRING LARGE WAREHOUSES IN FIVE CITIES AND BRANCH WAREHOUSES IN SEVERAL OTHERS.



ONE HUNDRED TWENTY-FIVE YEARS IN THE PAPER BUSINESS

IN THE YEAR 1819 a Quaker named Elihu F. Marshall, who was a cousin of Chief Justice Marshall of the United States Supreme Court, opened a small business as stationer, bookseller and publisher in a little village in Western New York. A few years later a country boy, named William Alling, walked into town and hired out to Mr. Marshall. The village has grown to be the City of Rochester and Marshall's enterprise has become The Alling & Cory Company, which in the year 1944 completes 125 years of business growth.

A detailed account of the various steps by which the Company has progressed from its small beginning to its present position might weary readers, but it is of interest to note that the firm has been engaged in business continuously during the terms of office of all

the Presidents of the United States except the first four, George Washington, John Adams, Thomas Jefferson and James Madison.

The earliest known document pertaining to the business is a letter from John Adams, Second President of the United States, dated March 7th, 1820, thanking "Friend Marshall" for a copy of one of his early publications called "The American Tutor's Assistant," which he had sent to Mr. Adams requesting him to review it. A facsimile of this very interesting letter is shown on page 32.

In 1825, when Lafayette visited the United States at the invitation of the President, he stopped at Rochester, N. Y., to receive and address a group of Revolutionary War soldiers. This meeting took place within a few feet of the entrance to the original store of The Alling & Cory Company, the business having been established there nearly six years before.

A photograph of an early advertisement of the business inserted by Mr. Marshall in the Directory of Rochester for 1827 is shown on page 34 and indicates the general nature of the stationery business in those days.

The following quotation from this Directory gives an interesting account of the means of transportation as they were at that time:

"The packet boats daily arrive at and depart from Rochester, both East and West, during the season of navigation, and afford excellent and comfortable accommodations. During the whole of the summer months, or from the first of May to November, the traveller is sure to meet, in these boats, a large company of the most respectable of both sexes; while the easy motion, and rapid progress of the boat, with the opportunity of alternate reading and conversation, beguile the tediousness of a long journey. These

boats run night and day, and accomplish about 80 miles in twenty-four hours. The fare, including all expenses, is generally about four cents a mile. The packet boat company have at present 12 boats and 130 horses."

Advertisements of both canal and stagecoach transportation, taken from this same Directory of 1827 are reproduced on pages 36-37. These indicate how leisurely passenger and freight traffic were handled in those early days. As a further comparison with our present-day spirit of hurry, note these remarks taken from an order received by The Company in 1829:

> *"We suppose there must be vessels coming down from Genesee River to the Harbour, yet this fall, so that you could send the above 'To the care of Butterfield, S. Harbour.' Should there not be, wait until the going gets better, and send by stage via Syracuse."*

LAFAYETTE AT A MEETING IN 1825, HELD A FEW FEET FROM THE ENTRANCE TO MARSHALL'S STATIONERY STORE.



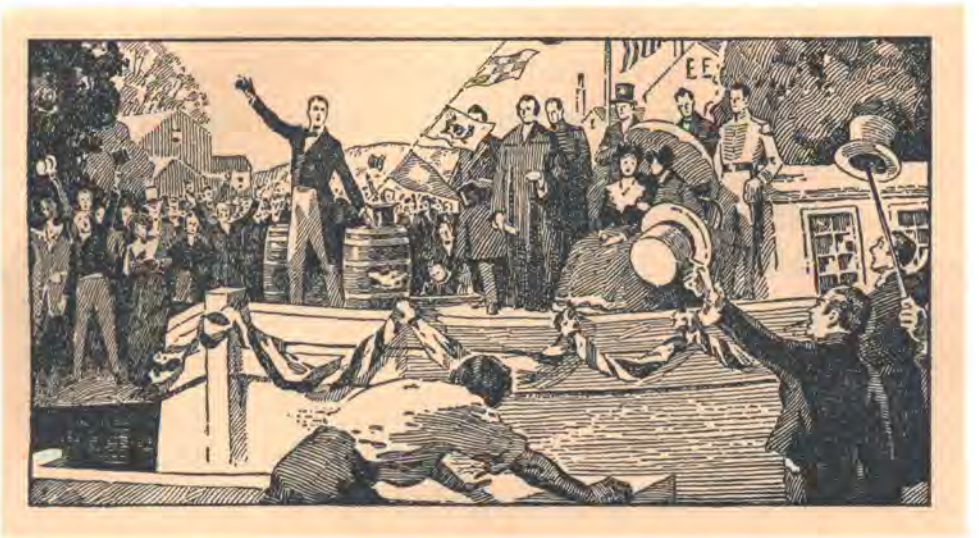
Fifteen years after establishment of the business, and following a number of changes in management, Mr. Marshall sold out to his clerk, Mr. Alling, who became the proprietor August 1st, 1834, and continued the business without interruption. Some time during the early days one of the clerks in the store was Millard Fillmore—subsequently President of the United States, while Washington Hunt, who was afterward elected Governor of the State of New York, was also an employee.

With some changes of partnership, William Alling conducted the business until his death in 1890, having associated with him in 1859 his cousin, David Cory, and his son, William S. Alling. This association laid the foundation for the Company name and business as they stand today.

It is not known just what quarters were occupied on the opening day of business, but the Rochester Directory issued eight years later shows the firm doing business in a small store containing less than 2000 square feet of floor space. Today the Company's warehouses provide a total of about 497,000 square feet of space to house the stocks required for customers' needs.

The little retail store in a country village of 1300 inhabitants has become a business requiring large fireproof warehouses in Rochester, Buffalo, Pittsburgh, New York and Cleveland as well as stocks of lesser degree in Akron, Ohio, and Syracuse, N. Y.

In reaching its present size the firm has occupied four buildings of its own in Rochester, besides other rented ones, while in Buffalo and Pittsburgh their present warehouses are in each case the third in the line of growth. To secure the Rochester location the Company bought nine old houses and lots in the oldest part of the city, backing up to the New York Central freight yards, the rec-



OPENING OF THE ERIE CANAL IN 1825. SIX YEARS BEFORE THIS HISTORIC EVENT MR. MARSHALL ESTABLISHED HIS STATIONERY BUSINESS IN ROCHESTER.

ords of these lots being shown on Liber 1, Map 1, in the city books of record. In order to secure the space, light and shipping facilities needed in Buffalo, three boarding houses, a grocery store, a livery stable and a Jewish Synagogue were bought, while in Pittsburgh a tract of land fronting on the Allegheny River was secured. To insure a safe foundation on this latter site, 980 steel-reinforced concrete piles were driven to an average depth of 25 feet, and upon these the building was erected. In Cleveland, the business, stocks and goodwill of the well-known house of Kingsley Paper Company were purchased in 1927 and soon became a full-fledged Division of the Company.

At this point it may be interesting to look back into the history of Buffalo, Pittsburgh, New York and Cleveland and learn what we may of the life and business of these places about the time Mr. Marshall set up his stationery and book store in Rochester.

In 1819 Buffalo was a village of about 1800 inhabitants, had one newspaper, "The Patriot," later the "Buffalo Commercial," and was striving hard to have the western terminus of the Erie Canal established there instead of at Black Rock, a village three or four miles down the Niagara River.

Pittsburgh, we find, had just been incorporated as a city with a population of 7000. It had a number of manufacturing establishments, including a nail factory (the first in America), a cannon foundry, four printing offices, two bookstores and a paper mill. This paper mill was established by two Quakers, Samuel Jackson and Jonathan Sharpeless, employed forty people, and turned out an annual product valued at $23,000. About this time also a Mr. Lothian, of Pittsburgh, established the first type foundry in this section, which was announced as "an establishment very important to the printers of the Western Country, who can now be supplied with every variety of type at the Philadelphia prices without the addition of carriage."

New York's population in 1819 was a little over 120,000 and was practically all confined to an area south of Houston Street. The city was served by seven newspapers, one of which, "The Evening Post," had been founded in 1801 by Alexander Hamilton.

Local transportation was by hackney coach and carriage. The main thoroughfare north was the Bloomingdale Road via Broadway. Distant points were reached by steamboats and the Mail Stage. The latter left No. 1 Cortlandt Street every day at noon for Philadelphia, Baltimore and Washington (fares $10.50, $18.00 and $24.00) and for Boston at 8:00 A. M. (fare $16.00). Stages also operated between points on Long Island, as far as East Hampton and to many points in New England and New Jersey.

The famous hostelry known as the "City Hotel," located on Broadway just north of Trinity Church, was described as "an immense building of 5 stories with 75 rooms." Some leading citizens met there in 1816 to discuss forming a savings bank. After much legal opposition the city's first savings bank was incorporated as the "Bank for Savings" in 1819. At this time there were ten commercial banks in New York and the total capital invested in manufacturing was only about $1,700,000.

Cleveland was indeed but a village in 1819, the total population being only about 150 persons. The business and residential sections were confined to Water Street and to that part of Superior Street between the Cuyahoga River and the Public Square. During that year the first cabin on the west side of the river was built,

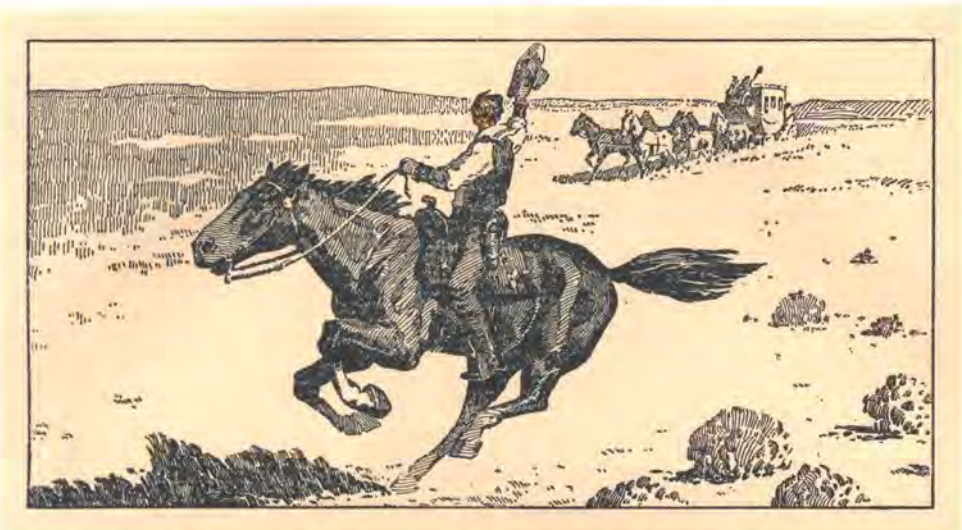
FOR 30 YEARS BEFORE THE FORTY-NINERS STARTED FOR CALIFORNIA IN SEARCH OF GOLD, OUR COMPANY HAD BEEN SUPPLYING PAPERS FOR BUSINESS USE.



and a two-acre lot on the public square was sold for $130 an acre "and this was then considered a fair price." Three or four years previous to this several new streets were laid out and named, one of these being St. Clair, the street on which the present Alling & Cory warehouse is located.

To those of our readers who are statistically minded, it may be interesting to compare the value of stock carried in the early days with that carried in the present buildings of the Company. There is no positive record of the amount carried during the first forty years other than that suggested by the amount of space which was devoted to its housing, but accurate inventories show the stocks carried since that time. One of the first inventories shows stock valued at from $20,000 to $25,000, but a May, 1866, invoice to a customer shows how different were the prices at that time from those which prevail today.

For example, tub-sized writing paper was 40 cents a pound; plain cover, or, as it was then called, "colored medium," 36 cents a pound; machine-finished book paper, folded in quires, 33½ cents a pound; super-calendered book paper, 40 cents a pound; and ruled billheads were 51 cents a pound. The old bill of goods from which the above items are selected amounted to $279.61; in 1944 this bill of goods would have totaled only about one-third of its valuation at the former prices. The $20,000 worth of goods carried in that little store would therefore equal only about $7,000 worth today while the goods at present carried in the Company's warehouses actually total well over a million dollars. The variety of the present stocks can be gathered from the fact that in Rochester alone about 4500 different articles or items are regularly carried on hand.



WHEN THE PONY EXPRESS WAS THE ONLY THROUGH MAIL SERVICE TO THE WEST COAST, THE ALLING & CORY COMPANY HAD ALREADY HAD 40 YEARS OF EXPERIENCE MEETING THE PAPER NEEDS OF BUSINESS.

In the early years of the twentieth century the Company added to its stocks of printers' goods other grades of paper for wrapping and packing purposes; and special departments for the handling and sale of these papers were established in each of its divisions.

Still other enlargements of the business introduced building and roofing papers, and special equipment for the manufacture of ruled papers, machine- and hand-made envelopes, and the lining of box boards.

Today new wartime needs have brought many new papers, and new uses for old papers, to help manufacturers meet the urgent needs of wartime activities. In fact a large share of the papers now handled by the Company are supplied either directly or indirectly for vital war purposes.

With the growth of business and the addition of new divisions the firm felt the necessity and advantage of incorporating in order

that the strong group of younger men and women who had been so instrumental in building up the business might become an integral part of the organization. Accordingly in 1908, the firm was incorporated under the name THE ALLING & CORY COMPANY with the following officers and directors:

JOSEPH T. ALLING,
President

HARVEY E. CORY,
Treasurer

GEORGE W. BURLING,
Assistant Treasurer and Secretary

ARTHUR H. SMITH
Vice-President and Manager Pittsburgh Division

MARTIN L. KRATZ,
Vice-President and Manager Buffalo Division

In 1935 Mr. Alling became Chairman of the Board of Directors, and Mr. Richard M. Harris was elected President. Two years later Mr. Alling died at the age of 82, having maintained active participation in the business up to within three or four days of his passing.

Succeeding Mr. Alling as Chairman of the Board and continuing as Treasurer of the Company, Mr. Cory served the business until the day of his death on June 29, 1939.

The thread of connection between Marshall's little stationery shop of 1819 and the present-day business of the Company is clearly defined in the following listing of firm names used by the business during these 125 years.

Firm Names 1819-1919

1819–1824—ELIHU F. MARSHALL

1824–1826—MARSHALL, SPAULDING & HUNT

ELIHU F. MARSHALL
SPAULDING
WASHINGTON HUNT

1826–1827—MARSHALL & SPAULDING

ELIHU F. MARSHALL
SPAULDING

1827–1829—ELIHU F. MARSHALL

1829–1830—MARSHALL, DEAN & CO.

ELIHU F. MARSHALL
ELISHA DEAN
"CO." UNKNOWN

1830–1834—MARSHALL & DEAN

ELIHU F. MARSHALL
ELISHA DEAN

1834–1847—WILLIAM ALLING

1847–1848—ALLING, SEYMOUR & CO.

WILLIAM ALLING
EDWARD TERRY
CHARLES SEYMOUR

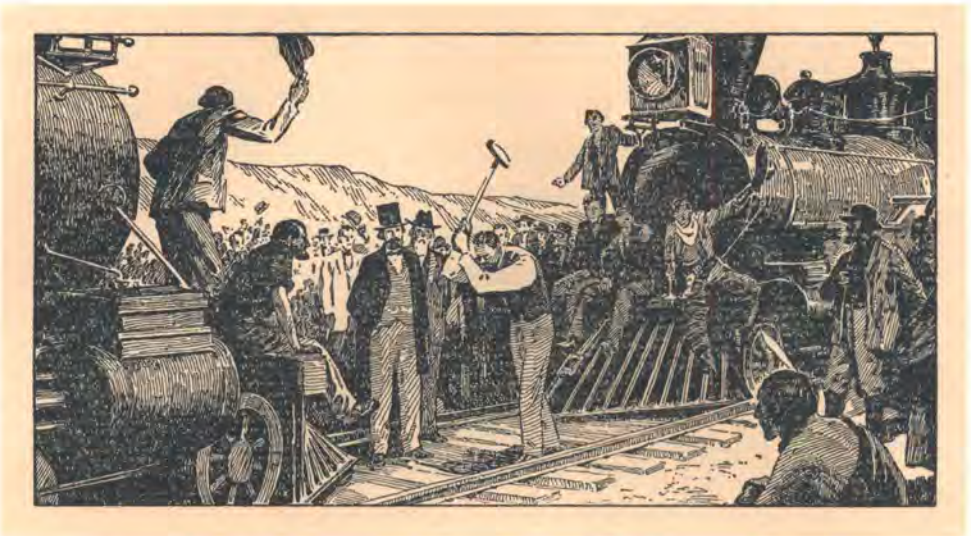
1848–1859—WILLIAM ALLING

1859–1872—ALLINGS & CORY

WILLIAM ALLING
WILLIAM S. ALLING
DAVID CORY

1872–1881—ALLING & CORY

WILLIAM ALLING
DAVID CORY



THE YEAR THE FIRST TRANSCONTINENTAL RAILROAD WAS COMPLETED SHORTLY AFTER THE CIVIL WAR, THE ALLING & CORY COMPANY CELEBRATED ITS 50TH ANNIVERSARY IN THE PAPER BUSINESS.

1881–1890—ALLING & CORY

WILLIAM ALLING
DAVID CORY
JOSEPH T. ALLING

1890–1893—ALLING & CORY

DAVID CORY
JOSEPH T. ALLING
DAVID W. CORY

1893–1897—ALLING & CORY

DAVID CORY
JOSEPH T. ALLING
DAVID W. CORY
HARVEY E. CORY

1897–1904—ALLING & CORY

JOSEPH T. ALLING

DAVID W. CORY

HARVEY E. CORY

1904–1908—ALLING & CORY

JOSEPH T. ALLING

HARVEY E. CORY

1908–1919—THE ALLING & CORY COMPANY

JOSEPH T. ALLING, *President*

HARVEY E. CORY, *Treasurer*

GEO. W. BURLING, *Assistant Treasurer and Secretary*

MARTIN L. KRATZ, *Vice-President*

ARTHUR H. SMITH, *Vice-President*

As the business grew, the number of Directors increased to provide full representation in the management for the various Divisions, and now in 1944 the business is guided by the following Directors:

RICHARD M. HARRIS, *President and Treasurer*
DAVID S. LANDAU, *Vice-President*
HERBERT S. KRATZ, *Vice-President*
JAMES E. ALCORN, *Vice-President*
HAROLD L. AUSTIN, *Vice-President*
JOSEF H. BUERGER, *Vice-President*
THOMAS R. WHITE, *Vice-President and Secretary*
CHARLES W. STUYVESANT, *Assistant Vice-President*
ROBERT F. PAVIOUR
WILLIAM D. ST. CLAIR
HAROLD L. ALLING
HOWARD K. WEED
MARTIN L. KRATZ, *Honorary Director*

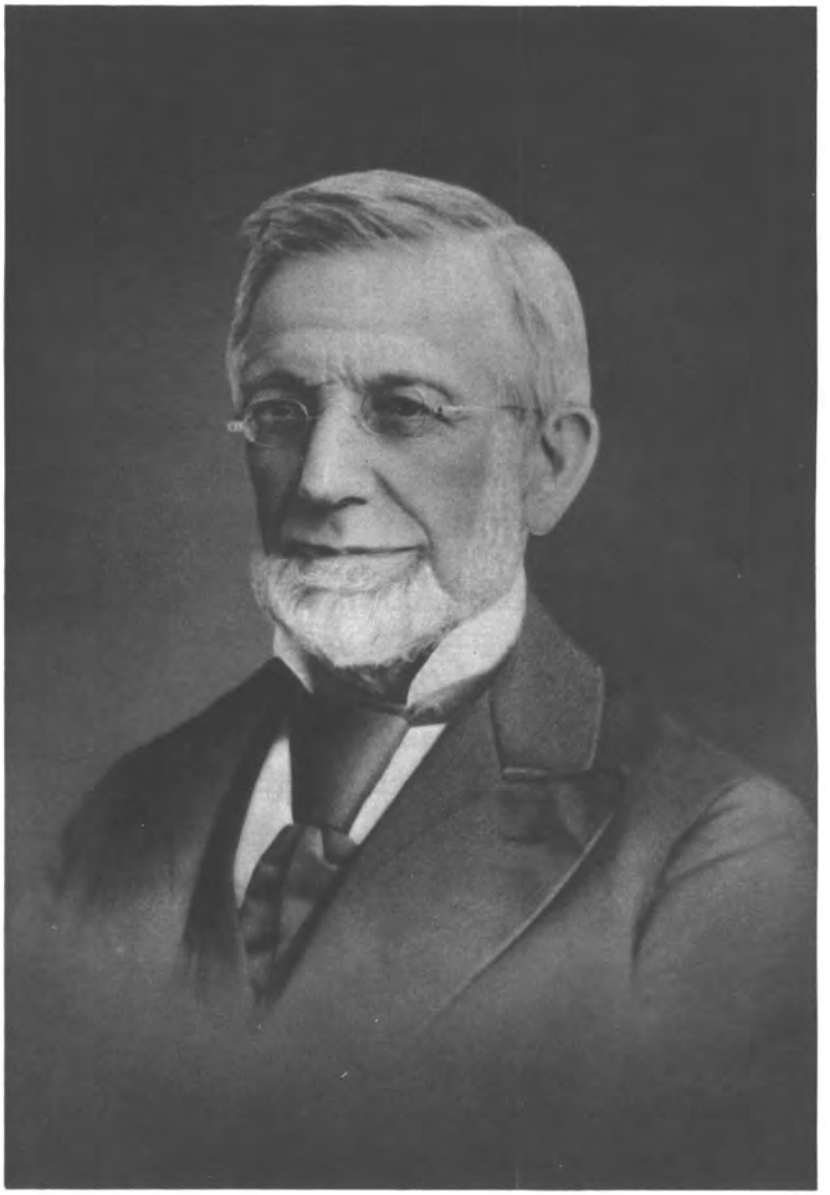
During the years from 1919 to the present, the following other individuals served as Directors until death or resignation deprived the Company of their services:

ALAN CHANDLER
THOMAS K. CREE
WALTER W. PLATT
BERT E. REEVES
KENNETH R. REID
ALBERT H. SEYLER
W. JOHN SHAW
WILLIAM T. SIBLEY
JOSEPH G. STEVENSON
ROGER H. WELLINGTON

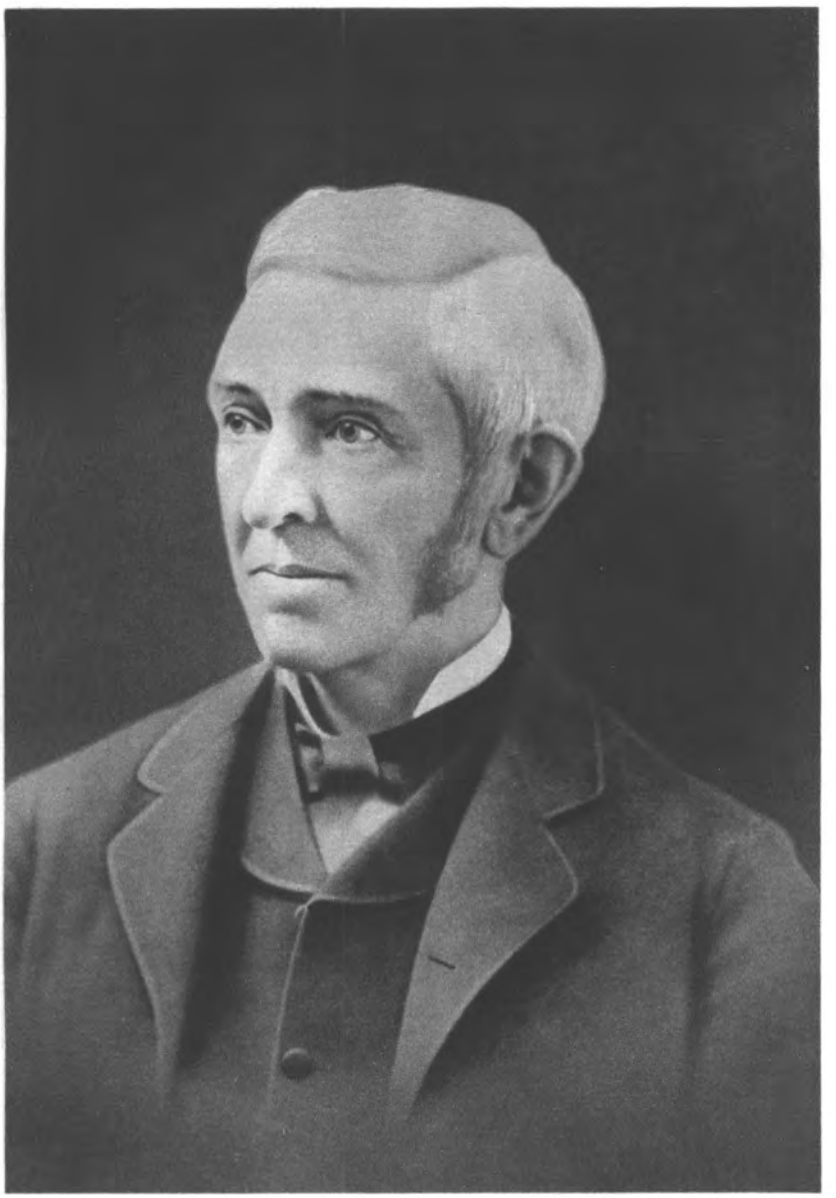
Today the firm has about 360 employees, many of whom are stockholders. Some of these employees have been with the Company 40 years, many have been here 25 to 30 years—while some have only just begun their training. Each endeavors to carry out the policies and practices established through the firm's 125 years of experience—to the end that our customers' every need may be met.

Upon the present books of the Company are the names of some customers and mills with whom the house has done business for over half a century—and some for 75 years; to these and to its newer friends the firm extends assurance that every effort will be made to render intelligent and efficient service through the years that lie ahead.

On the following pages there are reproduced portraits of the heads of the Company since 1834; also copies of documents and advertisements of interest in connection with the early days of the business.



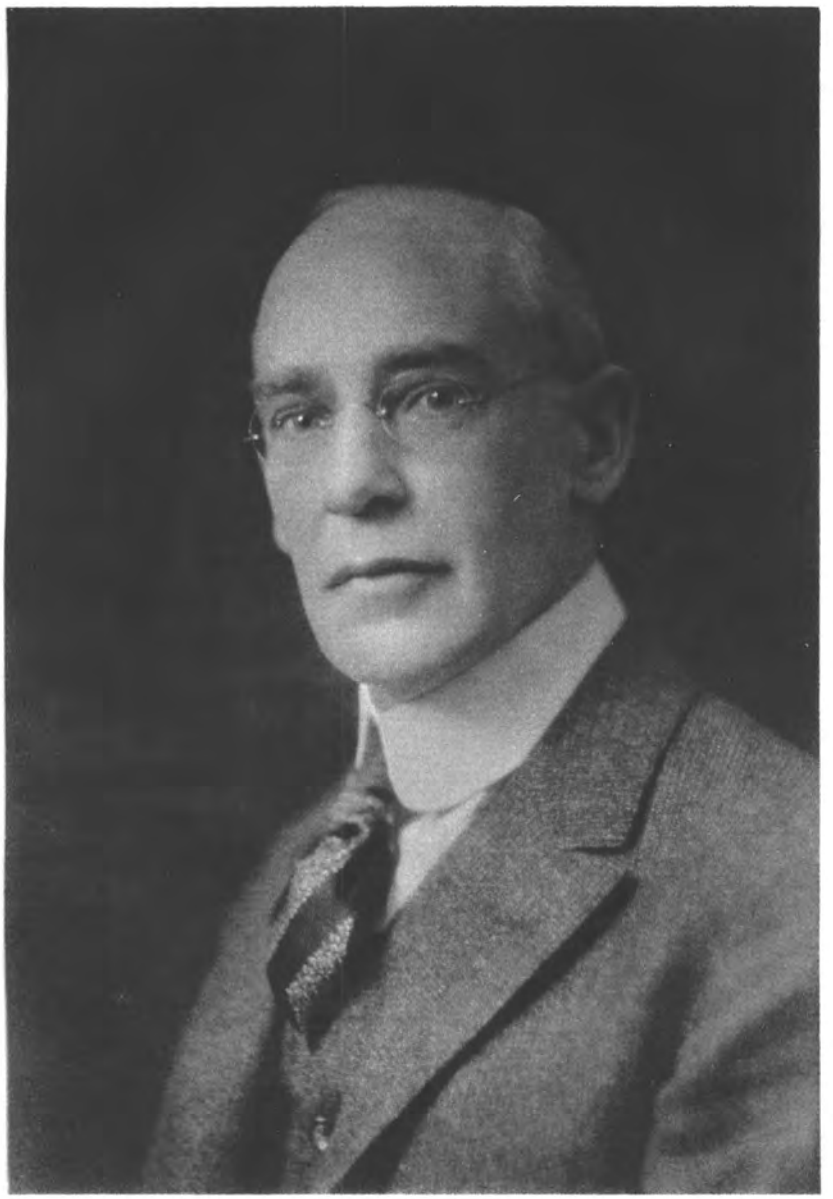
WILLIAM ALLING
1834—1890



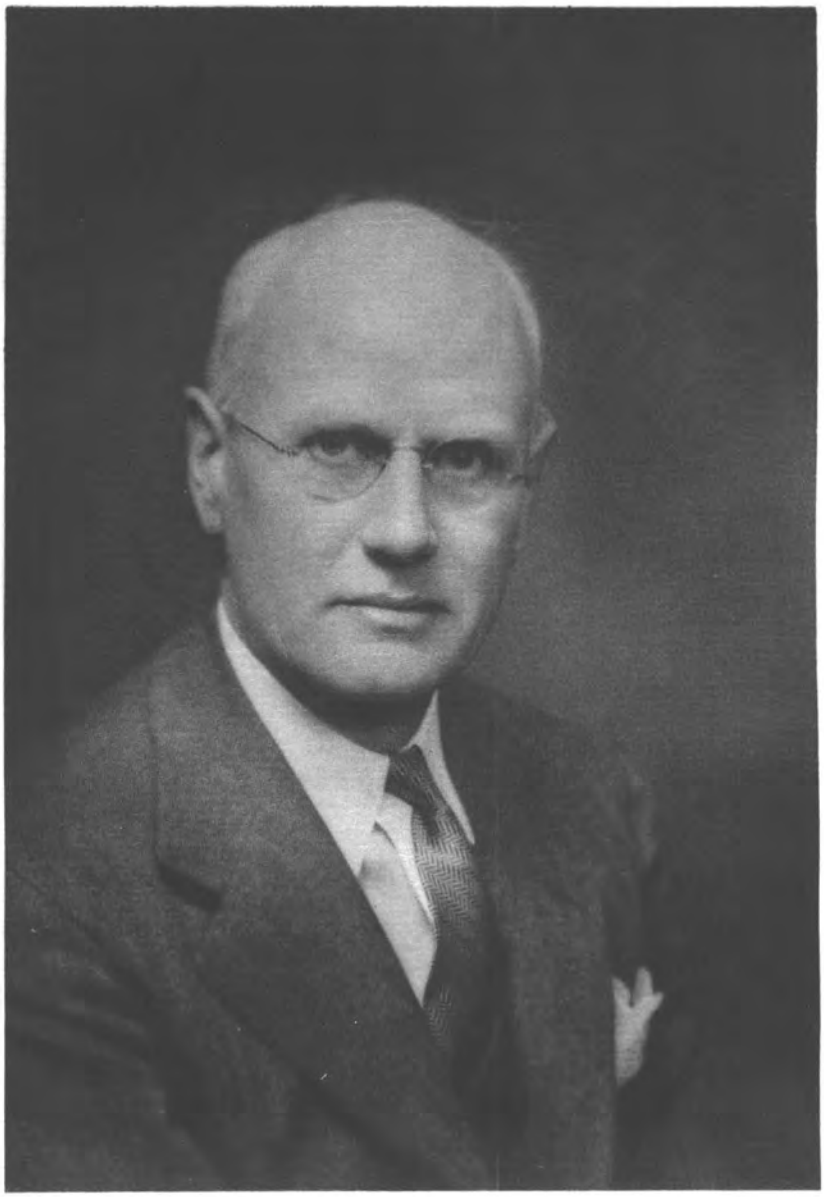
DAVID CORY
1859—1897



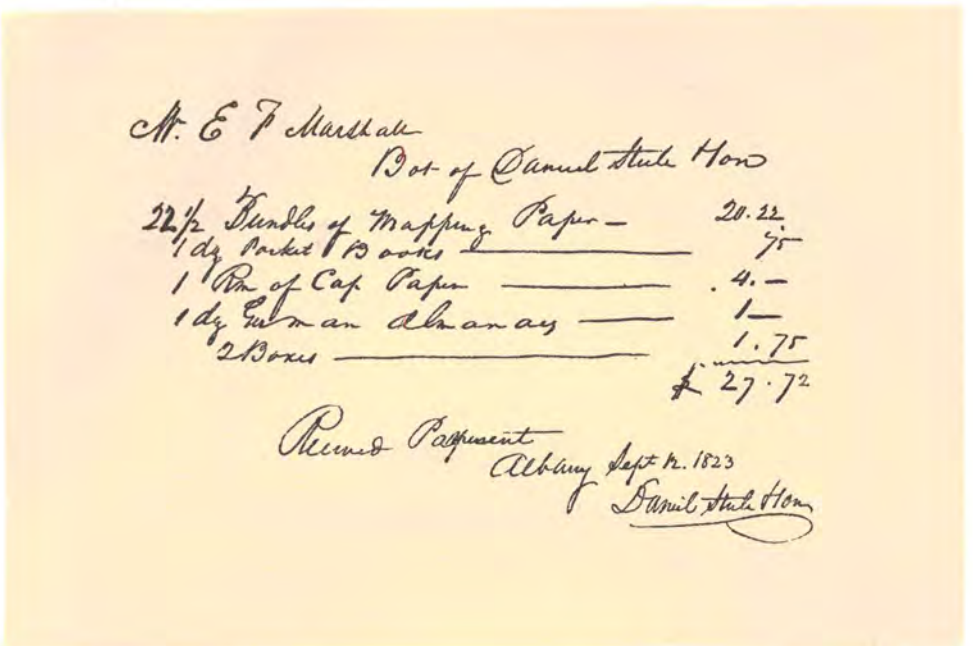
JOSEPH T. ALLING
1876—1937



HARVEY E. CORY
1884—1939



RICHARD M. HARRIS
President

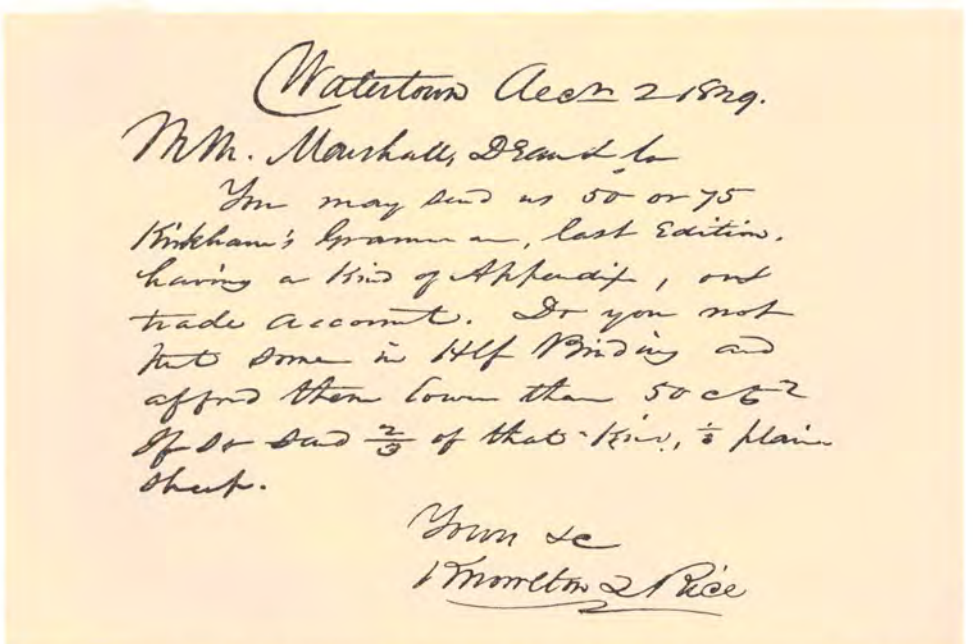


M. E. T. Marshall

Bot of Daniel Steele How

22½ Bundles of Mapping Paper — 20.22
1 dz Packet Books — .75
1 Rm of Cap Paper — 4.—
1 dz Gutman Almanacs — 1.—
2 Boxes — 1.75
£ 27.72

Recvd Payment
Albany Sept 12. 1823
Daniel Steele How



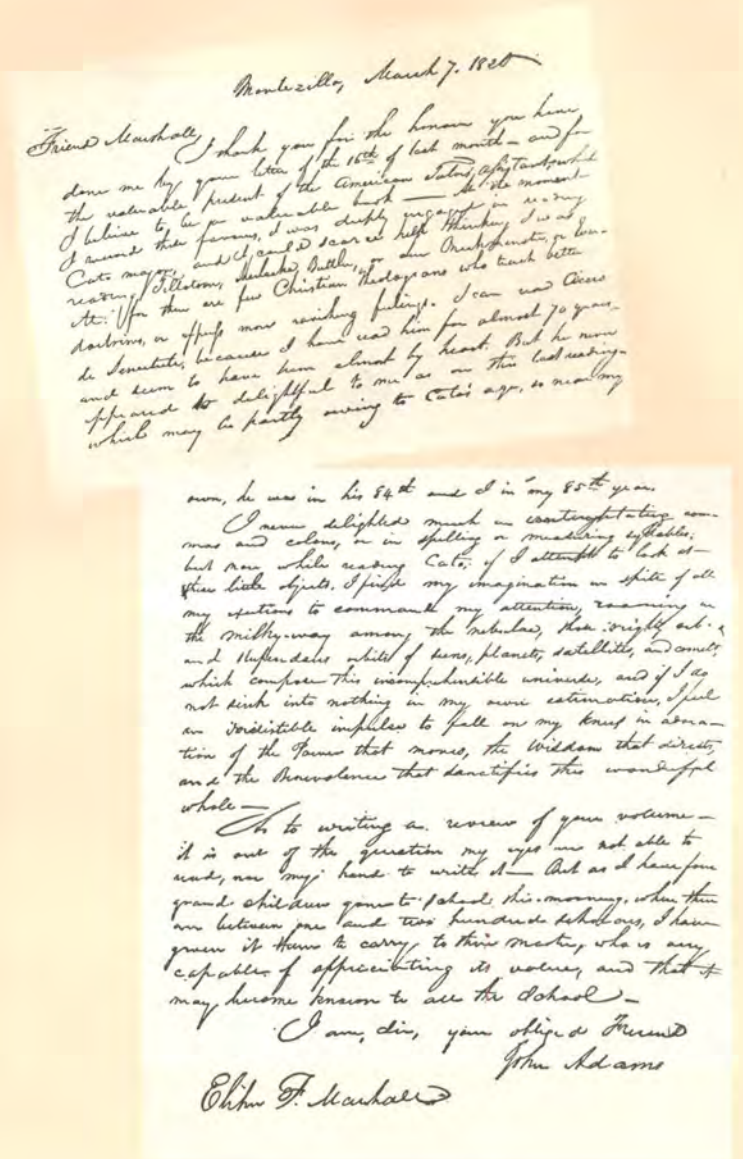
Watertown Dec 2 1829.

Wm. Marshall, Dear Sir

You may send us 50 or 75 Kirkham's Grammar, last Edition, having a kind of Appendix, and Trade Account. Do you not put some in Half Binding and afford them lower than 50 cts If so send ⅔ of that Kind, & plain sheep.

Yours &c
Hamilton & Rice

Top—THE OLDEST INVOICE IN POSSESSION OF THE COMPANY, COVERING ARTICLES PURCHASED IN 1823. *Bottom*—THE OLDEST ORIGINAL ORDER NOW IN THE COMPANY'S POSSESSION. DATED 1829, IT SPECIFIES SHIPMENT OF A QUANTITY OF "KIRKHAM'S GRAMMAR."



Montezillo, March 7. 1820

Friend Marshall, I thank you for the honour you have done me by your letter of the 16th of last month — and for the valuable present of the American Sailor, a[f]y Tarbox[e]d I believe to be a very valuable book — As to the manuscript sermons, I was duly engaged in reading them, and did scarcely high Thursday. I was at Cato's meeting, & heard Mr. Adams, of the Orthodox[e] persuasion, preach. Mr. Adams is one of those Christian Theologians who teach better doctrine, & offer more inviting prospects. I can read Adams de Sanctitate, because I have read him for almost 70 years, and seem to have him almost by heart. But he never appeared so delightful to me as in this last reading, which may be partly owing to Cato's age, as mine, now, he was in his 84th and I in my 85th year.

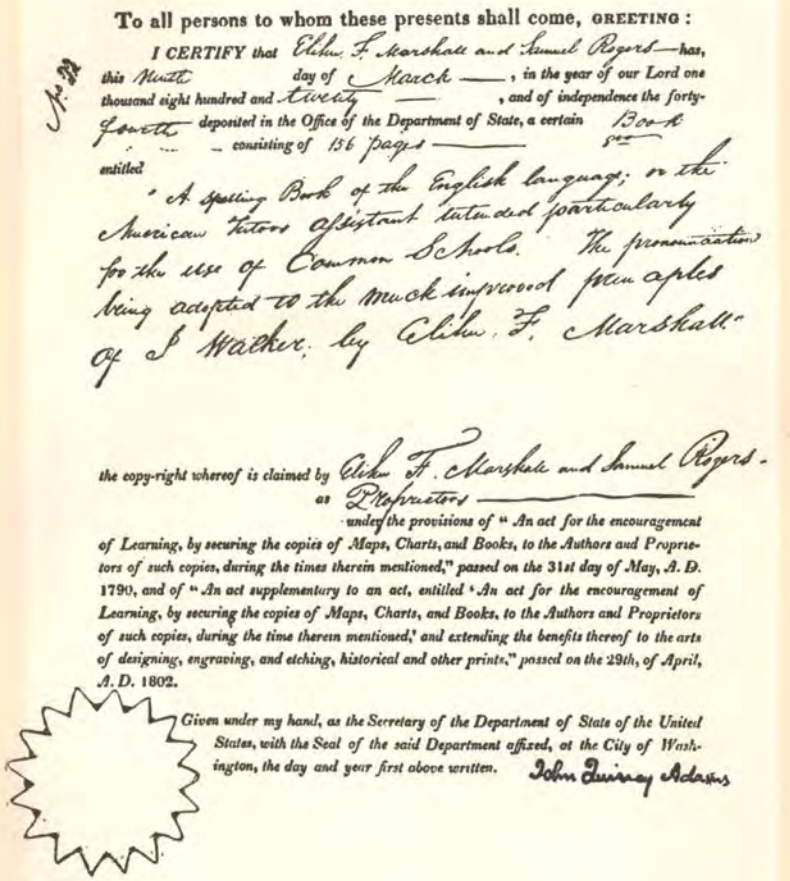
I am delighted much in contemplating commas and colons, & in spelling & reading syllables; but now, while reading Cato, if I attempt to look at those little objects, I find my imagination in spite of all my efforts to command my attention, roaming in the Milky-way among the Nebulae, those bright orbs and Unfathomable orbits of suns, planets, satellites, and comets, which compose this incomprehensible universe, and if I do not sink into nothing in my own estimation, I feel an irresistible impulse to fall on my knees in adoration of the Power that moves, the Wisdom that directs, and the Benevolence that sanctifies this wonderful whole —

As to writing a review of your volume — it is one of the questions my eyes are not able to resolve, nor my hand to write. — But as I have four grand children gone to school this morning, when they are between nine and two hundred scholars, I have given it them to carry to their master, who is very capable of appreciating its value, and that it may become known to all the School —

I am, dir, your obliged Friend
John Adams

Elihu F. Marshall

THE OLDEST KNOWN DOCUMENT PERTAINING TO THE BUSINESS—A LETTER FROM JOHN ADAMS, SECOND PRESIDENT OF THE UNITED STATES.



To all persons to whom these presents shall come, GREETING:

I CERTIFY that Elihu F. Marshall and Samuel Rogers—has, this Ninth day of March —, in the year of our Lord one thousand eight hundred and twenty —, and of independence the forty-fourth — deposited in the Office of the Department of State, a certain Book &c— consisting of 136 pages — entitled

"A Spelling Book of the English language; on the American Tutors assistant extended particularly for the use of Common Schools. The pronunciation being adapted to the most improved principles of J Walker. by Elihu F. Marshall"

the copy-right whereof is claimed by Elihu F. Marshall and Samuel Rogers. as Proprietors —

under the provisions of "An act for the encouragement of Learning, by securing the copies of Maps, Charts, and Books, to the Authors and Proprietors of such copies, during the times therein mentioned," passed on the 31st day of May, A. D. 1790, and of "An act supplementary to an act, entitled 'An act for the encouragement of Learning, by securing the copies of Maps, Charts, and Books, to the Authors and Proprietors of such copies, during the time therein mentioned,' and extending the benefits thereof to the arts of designing, engraving, and etching, historical and other prints," passed on the 29th, of April, A. D. 1802.

Given under my hand, as the Secretary of the Department of State of the United States, with the Seal of the said Department affixed, at the City of Washington, the day and year first above written. John Quincy Adams

FACSIMILE OF COPYRIGHT, SIGNED BY JOHN QUINCY ADAMS, ISSUED TO ELIHU F. MARSHALL, ON HIS BOOK, "THE AMERICAN TUTOR'S ASSISTANT."

(*No.* 9.)

EXCHANGE-ST. BOOKSTORE.



Elihu F. Marshall.

PRINTER,

Bookseller and Stationer.

Having assumed the late concern of *Marshall & Spalding*,) carries on these branches of business, to wit:

PRINTING.

He will execute, with neatness and despatch, all orders for Book or Job Printing:

.....SUCH AS.....

CARDS,	SHOW BILLS,
HANDBILLS,	BLANK RECEIPTS,
CIRCULARS,	WAY-BILLS,

STORAGE RECEIPTS,

OR, ANY KIND OF

FANCY,

Plain and Ornamental Printing.

BOOKS.

He has also on hand, or will procure, at short notice, Books of the latest and most approved editions, in

History,	*Voyages,*	*Theology,*
Biography,	*Law,*	*Poetry, Arts,*
Travels,	*Medicine,*	*and Sciences;*

TOGETHER WITH A GENERAL ASSORTMENT OF

CLASSICAL AND SCHOOL BOOKS,

As well as Sabbath School Books.

STATIONARY, of various qualities and prices, to suit purchasers, such as PAPER, of different kinds, *Blank Books, Justices' Blanks, Deeds, Mortgages, Bonds, Pocket Books, Pentils, Pens, Quills, Penknives, &c. &c.*

☞ BOOK-BINDING is also carried on, in its various branches. *Paper ruled* to order.

Rochester, 20th of 2d mo. 1827.

ONE OF THE FIRST ADVERTISEMENTS PUBLISHED IN CONNECTION WITH THE BUSINESS.

ESTABLISHED MORE THAN 25 YEARS AGO.

ALLINGS & CORY

SUCCESSORS TO WILLIAM ALLING,

BOOKSELLERS

AND IMPORTING STATIONERS,

Nos. 10 and 12 Exchange Street, Rochester, N. Y.,

Continue to offer a LARGE and WELL SELECTED STOCK of

SCHOOL, MEDICAL, THEOLOGICAL AND MISCELLANEOUS BOOKS,

Together with a choice assortment of English, French and American Stationery of their own importation. Among the goods recently imported are more than **1,000 Gross of STEEL PENS**, of various grades; **1,500 BIBLES**, varying in price from **30 cts. to $30. Billet, Note, Letter and Cap Paper and Envelopes**, of all colors, qualities, &c., &c.

THE MONROE COUNTY BIBLE DEPOSITORY

Being kept by us, we are prepared to sell all the publications of the AMERICAN Bible Society, at New York prices.

MUSIC BOOKS.

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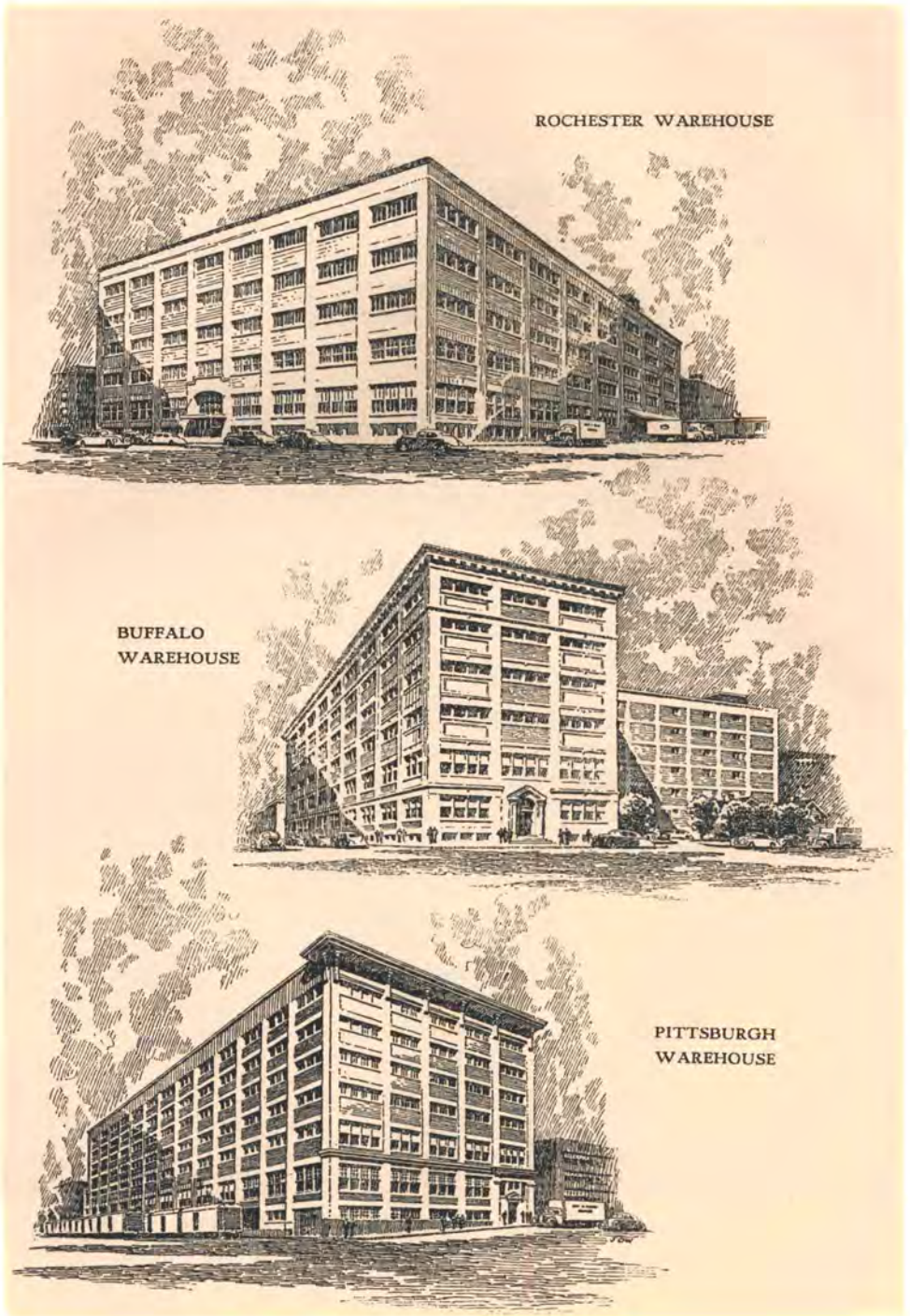
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PAPER

A BRIEF ACCOUNT OF HOW IT IS MADE

FIFTH EDITION
PUBLISHED BY THE ALLING & CORY COMPANY
1944

PAPER

A BRIEF ACCOUNT OF HOW IT IS MADE

BY

JOSEPH T. ALLING

WITH ADDITIONS AND REVISIONS

CONTRIBUTED BY

ELLSWORTH GEIST

THE ALLING & CORY COMPANY

ROCHESTER BUFFALO PITTSBURGH NEW YORK CLEVELAND

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PAPER

A BRIEF ACCOUNT OF HOW IT IS MADE

It has been said that progress toward civilization began when mankind discovered the art of embodying its knowledge in writing. The discoveries and acquirements of one generation were thus preserved and handed down to the children, who profited by the intellectual achievements of their fathers even more than by the inheritance of their material possessions. The complicated life of today could not be carried on without recording the details of its thoughts and transactions so that they can be preserved for subsequent reference by the writer or by others.

But the ability to write or print is wholly useless without the possession of some suitable material upon which to put the desired writing or printing, and I have little hesitation in claiming that the material most suitable for these purposes is entitled to a place in the very front rank of the agencies that have made for progress. Unquestionably paper is such a material, for to its surface are committed practically all the records of today's thought and life. A brief account of how paper is made may be interesting to some of those who use it without knowing much about its manufacture.

Two thousand years before Christ it was discovered that a substance well adapted to take and preserve writing could be made from a plant that fringed the banks of the River Nile; and it is this plant, the Papyrus, that



PAPER WAS FIRST MADE ABOUT 2000 B.C. FROM PAPYRUS, A WATER PLANT WITH A SLENDER STEM CROWNED WITH A BRUSH OR PLUME OF FINE GREEN FILAMENTS.

has given its name to the article of which I write, while its Greek name, Byblos, is transferred into our language in the word "Bible."

The Papyrus is a reed or water plant, with a slender stem, from half an inch to an inch in diameter, rising in height from ten to fifteen feet, and crowned with a brush or plume of fine green filaments, reminding one of the rise of a rocket and its sudden explosion in mid-air. This stem is covered with layer after layer of thin, whitish cellulose, very much as an onion is covered with a succession of closely wrapped coats or peelings. The stem was slit down the edge, and the layers peeled off, straightened out, laid side by side and glued together. Across them at right angles another series of strips was laid with the grain running the other way to prevent splitting, and the whole was pressed into a hard and smooth sheet. Rolls of this papyrus, thirty feet in length, have been found thickly covered with writing, and though these have grown brown and brittle with age, they are in better condition than much of the modern paper will be a thousand or even a hun-

dred years hence. So valuable was this manufactured papyrus considered that one of the kings of Egypt proposed to maintain his army from the sale of it. The great columns in the Hypostyle Hall of Karnak are crowned in alternate rows with capitals made to resemble the lotus bud and the spreading head of the papyrus plant, and these two plants furnish the motif for nearly all the columns and capitals in Egypt. This famous plant is today entirely unknown in Egypt, and is known to exist naturally in only three places: in Abyssinia, at Syracuse in Sicily, and in the marshes about the waters of Merom, north of the Sea of Galilee.

The endeavor to get some substance that would take writing more uniformly and preserve it more safely than papyrus led to the use of parchment, first manufactured in Pergamos, one of the "seven cities" of the Book of Revelation, and from this city the product took its name, parchment. The Germans call it pergamyn. This was the usual material for manuscripts till about the fifteenth century, when it first began to be superseded in the coun-

ROLLS OF PAPYRUS SERVED TO CONVEY MESSAGES AND RECORD TRANSACTIONS THROUGHOUT EGYPT.



tries of western Europe by the newly introduced product known as Paper.

Though newly introduced into Europe, paper was not a new product. It is said to have been first made by a Chinaman, Ts'ai-Lun, at about the time of Christ. For some seven hundred years its manufacture was known only to the Chinese, until the Arabs captured Samarkand, A. D. 704, and found there a well established paper-making industry. For many centuries the Arabs and Moors were the paper makers of the world, for they cherished the trade as part of the art of the scholar, and as necessary to the intellectual life. In the fourteenth century its manufacture appeared in the north of Italy, where all the paper for the early German printers was made. In 1687 its manufacture was introduced into England by the Huguenot immigrants, and three years later the first paper mill was built in America at Germantown on the Delaware.

The trade was welcomed eagerly in this country, and its value to the community recognized, for the State of Connecticut offered a bounty of twopence a quire for all paper made within its borders; the State of Massachusetts appointed a public official in each town whose duty it was to receive rags and save them for the paper mills; the State of New York exempted paper makers from conscription during the War of the Revolution, while the State of Pennsylvania would not allow them to enlist, deeming the uninterrupted practice of their trade of greater benefit to the community than their presence in the army. As the war advanced, the supply of paper for cartridges and wadding ran so low that the government advertised for it, and finally ordered the public to produce all they had, even sending files of soldiers to search for the indispensable article where there was any likelihood of finding it. In the garret of a house where Benjamin Franklin once had his printing office were found two thousand five hundred copies of a sermon by a Philadelphia divine on "Defensive War." These were seized and used to make cartridges for the battle of Monmouth. The results of the battle showed conclusively that it was "a most striking discourse." The proceedings of the second session of the New York Assembly in 1781 were not printed because paper for the purpose could not be spared, and a little

later the Postmaster at Troy issued a notice headed, "Please save your rags," and ending as follows: "The rich who regard the interest of their country will direct their children or domestics to place a bag or box in some convenient place as a deposit for rags that none may be lost by being swept into the street or fire; the sales of which will reward the attention of the faithful servant, and encourage the prosperous enterprise of prudence."

Up to the beginning of the nineteenth century all papers were made by hand, and indeed, a very little is still made in that way in England, Italy, and in this country, for special art purposes, while in Japan certain grades made from fibres peculiar to that country are made by hand with a perfection that is little short of marvelous. In the hand process of paper making, the prepared pulp mixed with plenty of water is lifted onto a piece of wire cloth stretched on a frame. The frame is shaken, the water drips through the wire, and the pulp, left in a thin sheet on its surface, is transferred to a piece of felt to be dried and pressed. The thickness is regulated by the skill

IN THE HAND PROCESS OF PAPER MAKING FIFTY POUNDS OF SMALL SHEETS WAS A GOOD DAY'S PRODUCTION.



with which the workman takes more or less of the pulp on his frame, and paper made in this way cannot well be as uniform as machine-made sheets.

We come now to the modern method of making paper. Assuming that it is to be made from rags, let us look for a moment at the great bales in which they are brought to the mills. Varying in size from 300 to 600 pounds, these bales are uncouth and unsavory objects. In addition to the rags which are gathered in this country over 388,000,000 pounds of rags have been imported in a single year, coming from all over the world. They are the catch-all of everywhere; the palace and the poorhouse have contributed to their store. The dirty blues and whites of oriental peasants' garments are pressed against fine linens and embroideries that have seen service in the gayest capitals of Europe. One becomes almost dizzy at the thought of the genesis of the stuff collected within the bands of burlap and wire that hold the bales together.

The bales having been cut open, the rags are run through a revolving cylinder known as "the thrasher" which is fitted with rotating wooden arms designed to dislodge some of the dirt with which many of the rags are heavily loaded. This dirt having been carried off by suction tubes, the rags are next sorted by hand, the buttons, hooks and eyes, rubber fabrics and close, hard seams that might hold dirt are cut out by women seated at tables around a big well-lighted loft. This is the dirtiest part of the mill, and the part where disease sometimes develops from infected rags. Next they are cut by a chopping machine into pieces an inch or an inch and a half square, and then put through an iron cylinder known as the "devil" or "whipper," where they are dashed about by a multitude of iron spikes which knock out as much more dirt as possible by shaking and tearing the material. They next pass into a wire-covered revolving cone, where, as they are tumbled about, a strong draft of air draws away the loosened dust and dirt. All these different processes are efforts to get rid of dirt and refuse by mechanical means, and when we reflect again from what sources great quantities of the cheaper grades of rags come, it will be realized that the methods are necessary in order to secure any degree of cleanliness in the product.



IN EARLY COLONIAL DAYS NOTICES WERE OFTEN POSTED WHICH BEGAN "PLEASE SAVE YOUR RAGS," AND OFFERED CASH IN EXCHANGE FOR THEM.

But the work of cleaning has only just begun. The rags are of all shades, stained and discolored, yet out of them must come a pure white or delicately tinted fabric, so they are loaded into great iron boilers or digesters, which hold from five to ten tons each. These boilers are charged with a mixed solution of lime and soda, and then, after closing up the manholes, steam is turned on and under a pressure of about 40 pounds, the great digester turns ponderously on its horizontal axis for twelve to fourteen hours. It is here that the cleansing process begins in earnest, for this scalding bath of steam-heated lime water in which the mass of rags is tumbled about for so long a time, loosens the colors, the starch, grease, glue, or any impurities the rags contain.

After being emptied out, the dirty mass is allowed to drain and is then shoveled into what are known as the "washing engines." These are great oval-shaped tubs, about twenty-five feet long by nine feet broad and three to four feet deep, capable of holding from one to two thousand pounds of rags

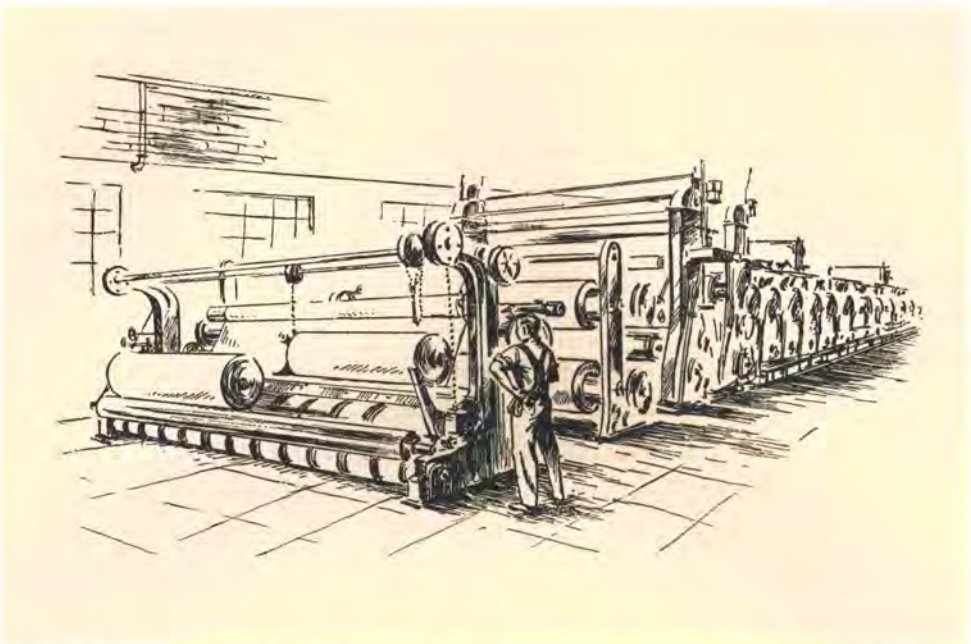
each. Each tub is divided for two-thirds of its length by an upright partition which makes a course around the vat like a race course around a driving park. Across this narrow course on one side of the tub is placed a heavy iron roll three to four feet in diameter, carrying on its surface as it revolves, iron bars or shears which work against other iron bars laid across the bottom of the tub in such an arc that they fit closely against the lower portion of the revolving roll. Between these two sets of bars or shears the rags are carried over and over again for hours, being cut and torn to pieces and reduced to a state of pulp, while all the time a great stream of clear, clean water is being poured into the tub, and carried off through sieves that hold back the rags but wash away the dirt. This water supply is one of the important factors in determining the location of a paper mill. A clear, soft water is most desirable, and while hard, dirty water can be wonderfully softened and purified by the enormous filters which are installed in some of our great mills, no expense is spared to get pure water from a spring or driven well. Some of the famous papers of Germany and France are believed to owe their peculiar properties to the spring water with which they are made, while Massachusetts and Wisconsin have become famous for their fine papers partly because the spring water coming off from the granite underlying rocks is more nearly neutral chemically and less impregnated with lime than the streams and springs of other sections of the country. As the fibres whiten and the water clears, the roll is lowered closer and closer to the bed plate beneath it in order to open up the fibres more thoroughly for the free circulation of the water among them. After a few hours the water is shut off, and a bleaching solution is put into the mass, which after a few more hours of mixing and grinding becomes clear and white. The dirty offscourings of ragdom from the four quarters of the globe have become clean and sweet and are ready to be made into paper. All the processes up to this point have been merely to clean the fibres; but from now on the processes are chiefly intended to prepare and treat the fibres so as to make the desired quality of paper.

As the first step in this direction the pulp, which is now called "half stuff," is emptied out of the washing engines into stone or brick rooms

called drainers, where the water and bleach gradually drain off, and leave the fibres white and compact. It may not be uninteresting to note that if the half stuff is hurried out of these drainers in a few days instead of being allowed to remain two or three weeks or longer, the paper made from it is more apt to curl when being printed or lithographed or coated for other uses, and is, besides, likely to develop a fuzzy surface, caused by the fine fibres that refuse to lie down in the sheet of paper, and that persist in sticking out in all directions like a shock of unruly hair.

From the drainers the half stuff is taken up to the beating engines. These are almost the same in design as the washing engines, and the pulp is again mixed with water and beaten by the revolving iron bars, until it acquires the desired fineness. It is during this process that the quality of the paper is determined more fully than in any other part of its manufacture. Here different qualities of rag stock are mixed to produce certain results of quality or price. Here, too, if at all, adulterants are put in and beaten together till they are thoroughly mixed. When desired, clay is introduced to increase the weight of the paper, or to improve its surface, and here, too, coloring matter is mixed with the pulp to produce tinted or colored papers. It may not be generally known that paper made without any coloring whatever would turn out a creamy shade, and that it is necessary to add ultramarine to the pulp to get a clear, bright white, just as a housewife adds bluing to the wash to improve its color. The cream color which unblued paper assumes is partly due, also, to the sizing of resin which is added in the beating engine, and which helps to make the finished paper hard and fit for pen and ink, or for the many other purposes where an unsized paper would be worthless.

The superintendent of the "beater" room in a paper mill is an important man, for not only must he understand coloring and mixing of stock, but he must know how to manipulate the stock skilfully under the revolving knives or bars of his engines; for good stock can be ruined by a little carelessness or ignorance, while skill and care can produce a superior article from relatively poor material. By merely changing the adjustment of the revolving knives the same stock can be made to produce a soft, flabby, tender



THE FOURDRINIER, A MODERN PAPER-MAKING MACHINE CAPABLE OF PRODUCING FIFTY TONS IN 24 HOURS.

paper, or a harsh, stiff and brittle paper, or a tough, strong and pliable article. It is this beating process, too, that takes most of the power of which paper mills use so much, for the revolving knives are not sharp to *cut* the rags, but are dull and are intended to *tear* and *grind* the rags apart in order to leave the fibres long and strong. Just in proportion as this result is secured must be the time and the power needed in this beating process. I have seen an engine of rags which had been undergoing the beating process for twenty-four hours heated so hot by the friction that one could not dip one's hand into the watery mass.

All these processes of cleaning, washing, bleaching and beating are more or less destructive of the fibre so that a shrinkage of from twenty-five to fifty per cent of weight occurs before the pulp is ready to be made into paper. In old rags the loss is much greater than when newer rags are being worked, but even new cuttings or clippings from shirt, shoe, or awning factories lose a considerable percentage of their weight.

When the operations of the beating engine have been completed, a most interesting process begins which marks a vast advance over the old method by which paper was made, a sheet at a time, on a wire frame manipulated by hand. Instead of making some forty or fifty pounds of small sheets a day, as of old, the modern machines make from fifteen to fifty tons in twenty-four hours, turning out this product in a continuous web from eight to fifteen feet wide, and of unlimited length; so that when a manufacturer was asked recently how large a sheet he could make, he answered that he could turn one out thirteen feet wide and a mile long.

It is about one hundred and forty years since the modern paper machine was invented, and like the cotton gin, it was practically complete when it first began to run, for though machines have been made larger, heavier and capable of turning out a greatly increased daily product, the essential features are unchanged. The inventors were two Englishmen with the French name of Fourdrinier, and the modern machines on which the great majority of papers are made are always known today as Fourdrinier Machines. These Englishmen got their machine going in 1803, the year of the Louisiana Purchase, and I have no doubt that great as the gain has been to the United States from the real estate transaction of Thomas Jefferson, the gain to our country has been still greater from the direct and indirect results of this remarkable invention of the Brothers Fourdrinier.

But to return to our rag stock which is ready to leave the beaters and go down into great cisterns known as the "stuff chests," where revolving paddles keep it mixed and moving till the paper-making machine is ready to receive it. On the way from the stuff chest to this machine a final attempt is made to free it from dirt and impurities of all kinds. It flows over what are known as "sand tables," a series of troughs provided with cross pieces forming grooves or pockets to catch sand or dirt. In many mills a series of powerful Electromagnets are provided to pick out any bits of metal that may have been left in the rags, and which, if not found, would damage the calender rolls, or, if too small for that, would produce what are known as rust spots in the paper. Then it is forced through a horizontal steel plate,

pierced with very fine slots, which, for the finer grades of paper, are only seven-thousandths of an inch in width and about a quarter of an inch apart. Through these tiny openings the fibres must find their way, leaving behind them at this "strait gate" all lumps, strings or knots which have failed to be perfectly beaten out, and which would mar the perfection of the finished product. In spite of all these precautions to insure purity, specky or dirty paper is no uncommon thing, and the two things that paper makers find it most difficult to guard against are coal dust and India rubber.

The stream of pulp is now about 98 per cent water, and it is difficult to believe that it contains separate fibres in sufficient quantities to make a firm, strong, substantial sheet of paper. But the critical moment is at hand. The pulp now flows out in an even stream upon a traveling, endless belt of fine wire cloth which carries it forward at a speed varying from one inch a second when making heavy bristol boards to twelve and even twenty feet a second for common newspaper. As this wire cloth moves forward it is shaken from side to side in order to interlock and mat the fibres, while the water drips through the meshes of the wire, or is drawn out by suction pumps beneath it. The thickness of the sheet is determined entirely by the amount of pulp which flows onto this traveling wire, along the edges of which run rubber guides called "deckles," which keep the pulp from spilling over. The rough edges (which appear on some antique papers) are called "deckle edges," because they are made by the slight leakage of pulp under these rubber straps which thus leaves a thin and uneven edge on the sheet.

If the paper is to be watermarked, it is done at this point; while the pulp is still moist and soft it runs under a revolving wire roll to the surface of which the desired letters or designs are attached. The impressions thus made on the pulp are not obliterated by all the subsequent pressing and calendering which the paper receives, but can be seen at any time by holding the sheet up to the light.

The matted pulp is still much too fragile to travel alone, and hence is delivered to an endless belt of moist felt, and carried between a series of heavy rollers which squeeze still more water out of it, and finally deliver it

to a row of iron cylinders which are steam heated to the temperature necessary to turn the paper out practically dry at the farther end. A magical change has been effected in a few minutes of time and within a space of one hundred and fifty feet, for these millions of independent, delicate fibres, forming a milk-white fluid, have been compacted into a fabric that is uniform, tenacious and hard, and that possesses much more strength than is ordinarily supposed. An incident that came under the knowledge of the writer will illustrate the point. The shrinkage in the size of paper is considerable after it is first formed on the wire cloth, for on a machine, say eight feet wide, the paper will shrink eight to ten inches in width before it is delivered dry at the farther end of the machine. This same shrinkage also occurs in length, and careful provision is made in all paper machines that the speed of the different portions of the machinery may be accelerated or diminished so as to allow for the greater or less shrinkage which takes place as the paper progresses toward its completed form. The failure to calculate this shrinkage correctly was the cause of the accident which showed the great strength which may be given to paper. A certain machine was preparing to run on bristol board, and had hardly more than started up when the paper by too rapid changes in its temperature shrank so much that its contraction lifted the ponderous iron drying rolls up out of their bearings, smashed the gears by which they were turned, and broke the framework of the machine itself. The surprising nature of this performance can better be understood when we realize that the modern paper machine weighs about four hundred tons, and is mounted with extreme care and solidity upon independent piers of masonry much as a telescope or instrument of precision is mounted, for it will not do its work well unless all possible tremor is eliminated.

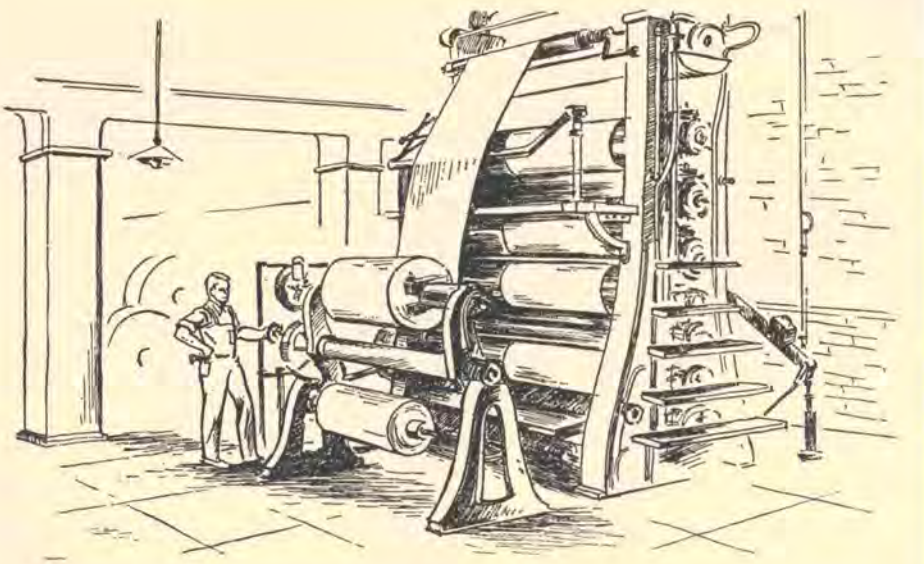
After drying the paper it only remains to pass it between rolls of steel or chilled iron called calenders which give it its finish, and then cut it into sheets or wind it up in great rolls for use on the modern web presses. When the paper in question is Newsprint, each roll contains from three to five miles of paper, and large city dailies use them up in incredible numbers;

some of them using, it is said, from a hundred and fifty to two hundred and fifty tons every day, while double or triple these amounts have been consumed in publishing special or holiday editions.

Where a high finish is required, the paper is subjected to a supplementary processing. It is passed through a second series of rolls, and every other roll is itself made of sheets of paper set upon an iron core, subjected to hydraulic pressure to solidify it and then turned to a true and solid roll in a lathe. The combination of the steel and paper rolls gives the highly finished article known as super-calendered paper.

The process above described is typical of all paper making, though modifications are introduced in order to meet special requirements. I have spoken of the introduction of sizing material into the beating engine where it mingles with the pulp, and prepares it to hold ink without spreading. But while

WHERE A HIGH FINISH IS DESIRED THE PAPER IS PASSED THROUGH THE "CALENDER STACK," A SERIES OF ALTERNATE STEEL AND PRESSED PAPER ROLLS.



that process is entirely ample for the ordinary kinds of paper, it does not make a paper hard enough to stand acid inks or to permit erasures. For all of the better grades of writing papers there is an additional method of sizing employed that gives the desired result. Less of the resin size is introduced into the pulp in the beater, but after the sheet has been made and dried, it is run through a bath of liquid gelatin made from starch or glue and applied hot. Enough of this sizing is absorbed to make the paper resist the action of ink in any climate, although in hot and muggy summer weather this sizing softens enough to allow some of the ink to pass through papers which otherwise are hard. Paper that has been run through such a bath of glue is called "tub sized," in distinction from that sized with resin in the beating engine and hence called "engine sized." In the case of rag paper, as it comes wet out of the bath of sizing, the sheets are taken up into great steam-heated drying lofts where they are hung over poles in bunches of about six sheets, as a laundress dries her clothes. The dried sheets are then put into presses to flatten them out, and are run between paper and steel rolls as above described, in order to give them a glossy finish. Many rag writing papers are made in this way and are called "loft dried."

Paper machines such as I have described are not fitted to make very heavy sheets of paper, for there is a limit to the amount of pulp that can be properly drained of its water before it leaves the wire and goes under the rolls to be pressed into shape. There are two ways of making very heavy sheets: one, by pasting light sheets together after they have been made and dried, and the other by making a series of light sheets on connecting machines and while they are still moist combining them into one thick sheet. The machines that do this are called "cylinder" machines. Instead of pouring the water and pulp onto a traveling wire cloth, this wire gauze is stretched around a cylinder several feet in diameter, which revolves in a vat filled with the watery pulp. From the inside of this cylinder the water is withdrawn enough to pull the water from the outside through the wire covering, leaving a thin layer of pulp on its revolving surface as it comes to the top of the vat. This thin layer of pulp is transferred to a felt and treated as in the

Fourdrinier machines first described. Machines designed for very thick papers are fitted with several of these wire-covered cylinders so that the thin sheets which they produce can be combined, forming one of the desired thickness. In this way papers are made that have a colored sheet on the surface and a white one inside, or have a firm, clear outside and a cheap stock inside. I do not know whether this is analogous to putting the best apples on top of the barrel, but, at any rate, that is one reason why every paper expert tears a sheet of paper when testing it to see not only the strength of the fibre, but also whether the quality is the same all through the sheet.

I have thus hastily described the main features of paper-making machinery. In so doing I have assumed that our work was being done with the old-fashioned material—cotton rags. But there are many other materials that make exceedingly good paper, and without which the industry could not be carried on today. In the first place there are linen rags. These make a little harder paper than the cotton rags do, but they have their disadvantages. They waste more in the processes of preparation, and, moreover, a thin paper made of all linen rags would curl much quicker when moistened or written on, and its surface is much more apt to blister and be rough. The so-called "Linen Papers," then, are made of a mixture of linen and cotton rags, and if the cotton rags are new and hard, they make a better article than if the finest linen of the English aristocracy had been the only material used. Government bills are made of cotton and linen with a stream of colored silk fibres dusted into the wet pulp before it is pressed and dried.

Paper is also made from burlaps or sacking; from hemp and from jute. The latter fibre comes mainly in the form of what are known as jute-butts, being the stubby, stumpy portion of the plant from which the softer portions have been cut for weaving purposes. Hemp reaches the paper mill in the form of old rope. This comes in huge coils, frayed and knotted, weather-beaten and worn, the color of wharves and wrecks with an odor of brine and tar, and if it could speak from the paper that it produces what tales it would tell of storm and tropical sun, of ice, of strange corners of the world and of all sorts and conditions of men. I have known paper, made from



HEMP FOR PAPER REACHES THE MILL IN THE FORM OF OLD ROPE. IT COMES IN HUGE COILS AND BALES, FRAYED AND KNOTTED, WEATHER-BEATEN AND WORN.

old ropes gathered in the oil regions, from which it was absolutely impossible to eliminate the odor of petroleum; so that each sheet betrayed its ancestry by its odor, as the Irishman does by his brogue. All these fibres waste materially during the various processes of preparation, so that it takes about 160 pounds of jute to make 100 pounds of paper, while 175 pounds of hemp are needed to make 100 pounds of finished product. The English paper makers use large quantities of a grass known as Esparto which grows in Northern Africa and in Spain and Portugal. It is used also for making cordage, baskets, etc., but possesses the quality of making a paper that is very thick for its weight.

The low price at which paper is sold of late years is due chiefly to the introduction of wood as a paper-making material. Its general use dates back to the latter days of the Civil War, although efforts had been made to use it much earlier. Wood is used in paper making in four different forms: 1st—mechanically ground; 2nd—chemically prepared by the Soda Process; 3rd—

chemically prepared by the Sulphite Process; and 4th—chemically prepared by the Sulphate Process.

The smaller proportion of the wood pulp produced in the United States is in the mechanical form. For this purpose spruce chiefly is used, for it makes a harder, tougher paper than any other. The logs are cut into two-foot or four-foot lengths; the bark is carefully removed by machinery, for every bit of bark left will make a spot in the paper if it cannot be screened out; the lengths are split into pieces like ordinary stove wood, and then these pieces are held sideways by automatic clamps against the sides of revolving grindstones with a thin stream of water playing upon them. This gives fibre that is fine enough to make a sheet of cheap paper when a proportion of chemical wood is mixed with it to hold it together. The mechanical method of preparing wood is, of course, very cheap, but it takes a great deal of power; at least fifty horsepower per daily ton of product being needed for a wood pulp mill—that is, a mill making 10 tons of ground wood pulp per day would have to be provided with 500 horsepower. Such a mill to succeed must be located where it can get at its wood and its power at a minimum cost, which accounts for the great number of paper mills in Maine, in New York State, and in Canada. Being in the region of wood the transition from tree to paper is a very speedy one. Some years ago a German paper manufacturer cut down a tree at 7:35 A.M., and at 10 o'clock read the day's news from a newspaper printed on paper made from the tree which he had cut down two hours and twenty-five minutes earlier.

A cord of rough wood would make almost a ton of paper, but such paper would not be good enough for general uses, and, accordingly, new methods have been developed for treating the wood chemically so as to produce a purer and stronger fibre. The first process discovered was that of boiling the chips of wood in a strong solution of caustic soda under steam pressure. This dissolves the gums and resinous matters, leaving the pure fibres of cellulose, fine, soft and silky. Beech, birch, poplar and maple are used in making what is called soda pulp, but it takes approximately one and three-quarters cords to make a ton of this fibre, so that it is much more expensive than mechani-

cally ground wood, not only because of the extra wood consumed, but also because of the cost of the process, which is known as the Soda Process.

Another method of treating wood is that known as the Sulphite Process. In this process the chips of wood, which may be spruce, pine, or hemlock, are cooked for about eight hours under steam pressure in a solution made by dropping lime water down a high tower through the ascending fumes of burning sulphur, forming an acid sulphite of lime. This solution was very destructive upon the boilers in which the wood was boiled, so that enormous amounts of money were wasted before any practical way was discovered of protecting these boilers. Now the great steel boiler, which is set upright, is lined inside with firebrick and cement, and so it is a slow and expensive process to build or repair these great sulphite digesters. They have to be handled with great care, too, for their walls are thick and made of diverse material whose rates of expansion and contraction are materially different. Too rapid rise of temperature inside when the air outside is cold has resulted in more than one explosion, destructive of property and life. It takes approximately two cords of spruce to make a ton of pulp by this process, but the fibre is long, strong and snappy, and of great value in almost all branches of the industry. Ordinary newspaper is made of about 20% of this sulphite pulp and 80% of ground wood pulp, the sulphite fibre being strong enough to bind together the shorter and more brittle fibres of the mechanical pulp.

In recent years another method of treating wood pulp has been developed. This is known as the Sulphate Process and is made use of in the manufacture of Kraft paper. The wood is barked and chopped just as in the other processes, but it is cooked with a solution of sulphate of soda in welded digesters, under very high steam pressure. This cooking lasts from two and one-half to four hours, the longer cooking producing the better fibre. As the wood comes out of these digesters, it is coarse and has to be thoroughly broken up before it can be made into paper, and the shorter the period of preparation, the coarser the pulp. In normal times, some of this sulphate pulp is imported from Sweden, Norway, and Canada, but great quantities

are now being manufactured in this country. The amount of spruce consumed in producing a ton of pulp is about the same as that in the sulphite process, or about two cords of wood for a ton of pulp. The unbleached sulphate pulp is brown in color, like the well-known brown of Kraft paper, but this pulp may be bleached for use in white paper.

Most of the paper produced in the United States is made from these different forms of wood pulp, and because of this great supply of inexpensive fibre the prices of papers have been brought down in most marked degree during recent years. During the Civil War common newspaper sold for twenty-five cents per pound. Ten years later, after the resumption of specie payments, it sold for ten cents a pound, while still later the price went down to a cent and a half per pound. It is higher now, ranging at different times from four to six and one-half cents per pound, and probably will never again go to as low a point as it did a few years since, for the question of a waning supply of wood is as vital to the paper makers as to the lumber men. What white pine is to the lumber trade, spruce, pine, and fir are to the pulp and paper trade, and the competition for forest land has grown keen. Of course the consumption of wood for fuel and for lumber is much greater than for paper, taking the country as a whole, but in some sections the paper industry shows up as a great leveler of forests.

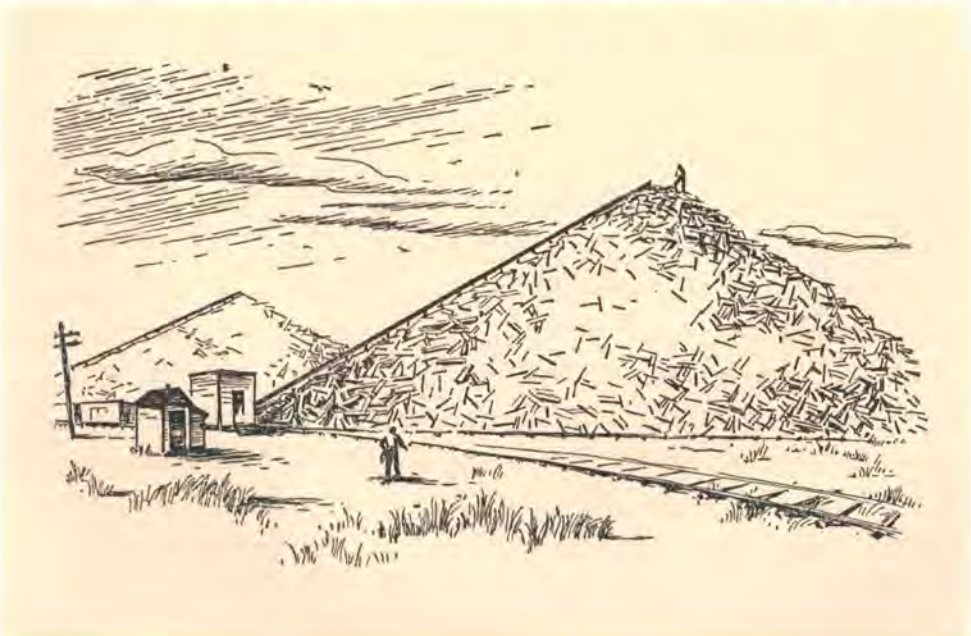
The large paper companies are becoming careful of their timberlands. When they cut timber, they use saws instead of axes, and they cut closer to the ground. Moreover, they are working their forest preserves with some care, cutting over the land from time to time and taking only the trees of larger diameter. The labor cost of this method is greater, but it is estimated that the ultimate results will make a saving.

When the timber is cut in this careful way, it yields from 5 to 15 cords per acre, the average yield being about 10 cords. Of course, if the land were stripped, taking small and large trees alike, without regard to a future cut, the product would be much larger, perhaps running 20 or even 30 cords to the acre; but this would exhaust the land for at least 100 years, as it takes a spruce tree about that time to attain a good size. If, then, I as-

sume a yield per acre of 20 cords, it would take about 50 acres of forest to supply the newsprint which is consumed every day in New York City, for not so long ago the papers of the Metropolis were using approximately 1,000 tons of Print paper each day. If the yield per acre were less than 20 cords, the amount of acreage would be correspondingly greater.

Paper men have ever devoted their attention to the possibility of using some other form of fibre to take the place of spruce as it increases in value. Hemlock and southern pine are already being used, also the gum tree of the South, which is not very unlike the quick-growing poplar; and extensive experiments have been undertaken in search of a still quicker growing crop that will annually give the paper maker an abundant supply of fibre. Every plant has more or less cellulose. This is compounded and buttressed with resinous and other foreign substances that must be gotten rid of before the true cell-tissue is available for paper. The questions asked of each abundant crop are, "How large a proportion of your bulk is cellulose?" and next,

A TYPICAL PAPER-MILL WOODPILE. THESE PILES OFTEN CONTAIN MORE THAN 125,000 CORDS OF WOOD.



"How expensive is it to get rid of everything else and leave the pure fibre?" On these two questions hang all the profits, if not all the law.

Cottonseed has been used after the oil has been pressed out of it, and good paper has been made from it, but at considerable expense. Bagasse, or the waste sugar cane left after grinding, has been tried, but a great quantity of this bulky material must be handled in order to get one ton of pulp. Too expensive! Cornstalks have been experimented with, but practical difficulties have precluded their use.

For the present, we must count largely on wood as our source of fibres for the making of paper, and so a pulp mill that expects to use wood must get up into the woods, or, at least, close along their fringe. It must at the same time secure abundant and cheap water power, but must not be out of good railroad connection with the rest of the world. It is as foolish to attempt to make money in a poorly located paper mill as it would be to build sea-going steamers in an inland village. Mills that expect to make rag papers must have easy access to some of the great centers where domestic rags are gathered. Earlier in the development of America, certain kinds of mills located themselves in the larger cities, where they gathered the old newspapers and the litter of dry goods and other stores, where the old wrapping papers were baled up and used over again to make junk boards for book covers, and where they took the cheapest sweepings of the streets and the refuse of the rag pickers and made a common wrapping paper for packing furniture, for lining packing cases, or for other purposes requiring neither strength nor beauty. Between Duane and Reid Streets in New York City runs Elm Street, and there for many years within a stone's throw of the City Hall was a paper mill grinding over the litter of the great city. Latterly, the manufacturers of wrappings and boards have withdrawn from the cities. The manufacturers of wrappings have moved southward. The manufacturers of board continue to require great quantities of old newspapers, old magazines, and other waste paper, but these are gathered by dealers throughout the nation and shipped in carloads to the board mills.

One more word as to the use of wood fibre in paper making. When wood

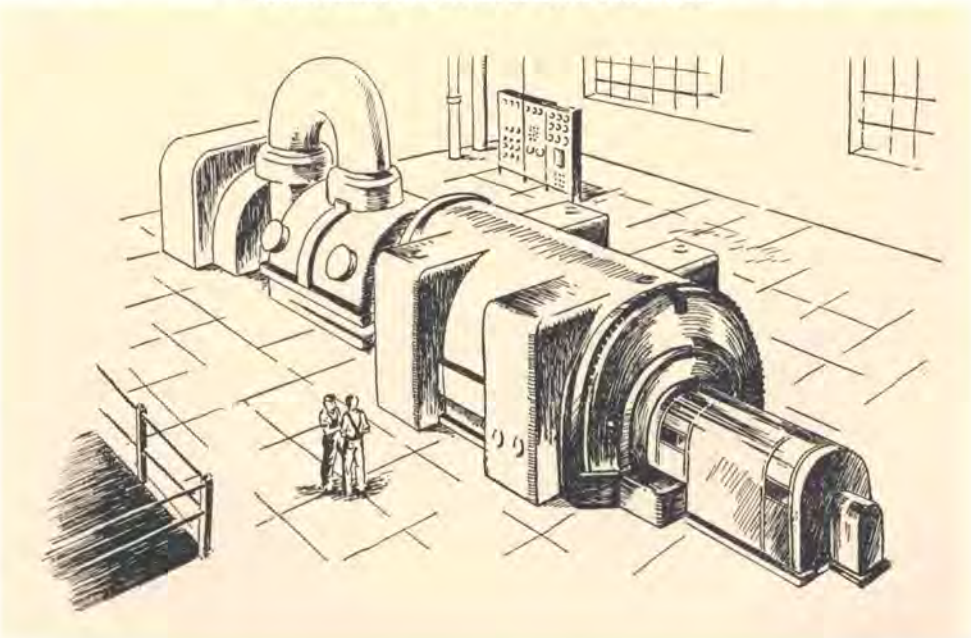
pulps were first used, the paper made from them was not durable. Even now, papers made of mechanical pulp will become discolored and weak in a brief time. However, chemical wood pulps have become increasingly durable as the methods for processing them have been improved. Laboratory tests of pure chemical wood pulps give us reason to assume that they may last for many years, and papers made of chemical pulps and printed 56 years ago still exist in good condition.

The wealth of illustration with which our modern periodicals are enriched is rendered possible by the perfection of the art of the paper maker as well as by the skill of the photoengraver, for it would be entirely impossible to produce the present results upon the very best paper made thirty years ago. So prominent a part does illustration play in modern printing that a few words may not be out of place on the method of preparing the paper for it. It is almost entirely a matter of surface treatment, for the fine lines produced in photoengravings could not be shown on a page of rough paper. Much is done by the calenders and super-calenders to squeeze down the surface of the paper and make it smooth, but a magnifying glass shows the smoothest of such surfaces to be full of the inequalities left by the wire cloth upon which the paper was formed. These cannot be removed, no matter how hard they are calendered; so the modern paper maker proceeds to fill them up with a surface coating of clay. The best clay is mined in the southern part of the United States, largely in Georgia, and is refined until it has the appearance and texture of a fine quality talcum powder. This clay is mixed with casein, starch, or glue in a solution of about the consistency of milk—the casein, starch, or glue serving as an adhesive and binding the clay to the surface of the paper. The paper to be coated is brought to the coating machine in great rolls, its surface being left uncalendered, and its pulp without much sizing, so that the surface coating may better enter the pores of the sheet and be less in danger of peeling off from the surface. The end of the roll of paper is passed through the vat containing the coating mixture, then between rolls which spread the sticky solution evenly, then between two sets of brushes, one above and the other below, which oscil-

late rapidly for the purpose of working out any lumps in the clay, and making the coating as absolutely uniform as possible. These sets of brushes are of different fineness, the last one to touch the paper being of the finest camel's hair which leaves almost no mark on the coating. A recently developed device for applying coating employs a razor-thin blade of air, which is used in place of brushes, and which slices the coating down to an even, smooth surface. The coated web of paper leaves the machine wet and sticky on both sides, and is carried through the air, supported on successive blasts of hot air which blow up under it at intervals of about three feet, so that the paper goes fluttering through space for perhaps a hundred feet, by which time it is dry enough to be caught up and suspended automatically in great loops on a traveling dryer which carries it slowly through a long room, heated to about 140° Fahrenheit. After being thoroughly dried and wound into a roll, the paper is threaded between calendering rolls, which press upon the traveling white web and give it the desired finish. Then it is cut up into sheets. All sheet papers are sorted and counted by hand, as no automatic machinery has yet been invented to separate the sheep from the goats and throw out the imperfect stock. The paper maker is constantly called upon to produce an article with new properties so as to adapt it to particular uses, or to make possible some desired invention. The manufacturer of cutlery wants a strong paper to wrap his knives in without rusting them, so a paper is made without any acids or bleaching powders and is sold as antirust paper. The silverware maker wants his paper bleached pure white, but cannot permit the use of acids for fear of tarnishing his product, so a grass-bleached paper is produced, known as silver tissue. The soap manufacturer must have a paper that will not be affected by the alkali of his soap, and an alkaliproof paper has to be made. The dairy man, the tobacconist, and men in other branches of business demand a waterproof, airproof paper for wrapping their wares, and the paper maker responds by coating his product on both sides with paraffin or lacquer, or by making wax paper, or by dipping it into a bath of 65% sulphuric acid, then into cold water, and then into diluted ammonia, by which means he secures a tough, transparent,

glossy, impervious substance known as "vegetable parchment." Blue paper for starch boxes must be colored in a certain way; blue paper for seidlitz powders must have no coloring in it, but must be made from selected blue rags which impart their color to the paper without danger to the substances to be wrapped in it. Paper for the photographer must be made in mills in which brass and bronze replace many iron parts in the machinery. The maker of lunch boxes wants a thick paper that will be both grease- and waterproof, that will be stiff enough to hold its shape and limber enough to fold up and be put in the pocket when empty without cracking at the folds. The manufacturer of sticky fly paper asks for a sheet that will be impervious to oil, to benzine or to any combination that can be put upon it; and the manufacturer of carbon papers asks for a filmy web of tissue paper that will be so absolutely perfect that not even a pinhole shall permit his black and greasy dope to penetrate it. The shoe manufacturer asks for a heavy board that will cheapen the cost of his soles and heels, and the paper mill turns

LARGE QUANTITIES OF PAPER ARE USED FOR INSULATING PURPOSES BY MAKERS OF GENERATORS, TRANSFORMERS AND OTHER ELECTRIC APPARATUS.



him out what is known as "leather board." The camera maker wants a stiff, black sheet that will not warp, and that is cheaper than black vulcanized rubber—and gets it. The makers of generators and other electric apparatus such as transformers, condensers, etc., consume enormous quantities of paper for insulating purposes, finding it almost as satisfactory as mica and much more satisfactory in the size of its sheets and its price per pound. The lithographer demands constantly larger presses in order to cheapen his cost of production. Then he requires his paper maker to furnish him with a sheet of paper about as big as a bed-blanket, which will stand the repeated dampening of the lithographic process, and the tremendous pressure of the great power presses without shrinking or stretching the smallest fraction of an inch, and the paper maker gives it to him after much tribulation.

I have spoken of a few of the uses to which paper is put in the field of manufacture. We carry water in paper pails, pack flour in paper bags, ice cream and oysters in paper boxes. We hang our walls with it to increase their beauty, cover our roofs to keep out the rain, sheathe our houses to keep out the wind, line our carpets to keep out the moths and increase our comfort. We fan ourselves with paper fans, wipe our faces with paper handkerchiefs and napkins, sometimes chew our food with paper teeth, wear paper collars, row in paper boats, go on our journey on paper car wheels, and are buried in paper coffins.

Nearly one-half of all the paper made on the globe is made in the United States. The paper industry is not so great as many others in the value of its production measured in dollars, but in no branch of industry is the preeminence of this country more decisive than in the manufacture of paper, and I think that a good deal might be said in defense of the proposition that of all our industries, this is the most important as an adjunct in the onward march of civilization.

There are now about 240 pulp mills and 726 paper and paper board mills in the United States. In 1900 the estimated capacity of those mills was less than 10,000 tons per day, which increased, however, during the years preceding the first World War until it aggregated about 22,000 tons. The total

paper-making capacity in 1942 was approximately 59,400 tons per day. This was divided about as follows:

News paper	3,240 tons*
Book paper	6,475 tons
Paper boards of all kinds	27,350 tons
Wrapping paper	10,100 tons
Writing and cover paper	3,500 tons
Tissues	3,240 tons
Building papers	3,070 tons
All others	2,410 tons

*A major proportion of the newsprint consumed in the United States is manufactured in Canada and imported.

The capacity of the wood pulp mills in the United States in 1942 was approximately 37,000 tons per day, and this capacity was divided approximately as follows:

Ground wood pulp	7,870 tons per day
Sulphite wood pulp	10,320 tons per day
Soda wood pulp	1,680 tons per day
Sulphate wood pulp	16,420 tons per day
Semi-chemical	770 tons per day

These tabulations disclose that the wood pulp capacity accounts for only a little more than 62% of the paper-making capacity. This discrepancy is explained by the fact that other pulps, and substances other than pulp, are employed to produce paper. Clays and the adhesives are put into or on papers, and these weigh in the total tonnage. Old newspapers, magazines and wastepapers are converted into pulp—mostly for the making of paper board, and approximately 15,375 tons of pulp are secured each day from these waste materials. In addition, rags, hemp, jute and such materials are used to produce pulp for the manufacture of writing papers, tissues, and specialty papers.

The wood pulp used for paper making in the United States comes, for the most part, from domestic woodlands. Ordinarily, some pulp and some

wood are imported from the Scandinavian countries and from Russia, but the supply from these sources has shrunk to a mere trickle since Germany launched the present war. The total consumption of pulpwood in the United States in 1943 was approximately 15,000,000 cords, and of this total, approximately 1,650,000 cords were brought in from Canada. Therefore, approximately 89% of the pulpwood consumed in 1943 was cut in the woodlands of the United States.

The principal pulpwood states—*not* listed in the order of their importance—are:

Northeast and Central—Maine, New York, Pennsylvania, New Hampshire, Vermont.

Lake States—Michigan, Wisconsin, Minnesota.

Southern States—Florida, Louisiana, North Carolina, Virginia, Alabama, Arkansas, Georgia, Mississippi, South Carolina.

Pacific Coast—Oregon, Washington.

The leading states in the manufacture of paper are ranked as follows in the approximate daily production, together with the number of mills (These figures are for the year 1939).

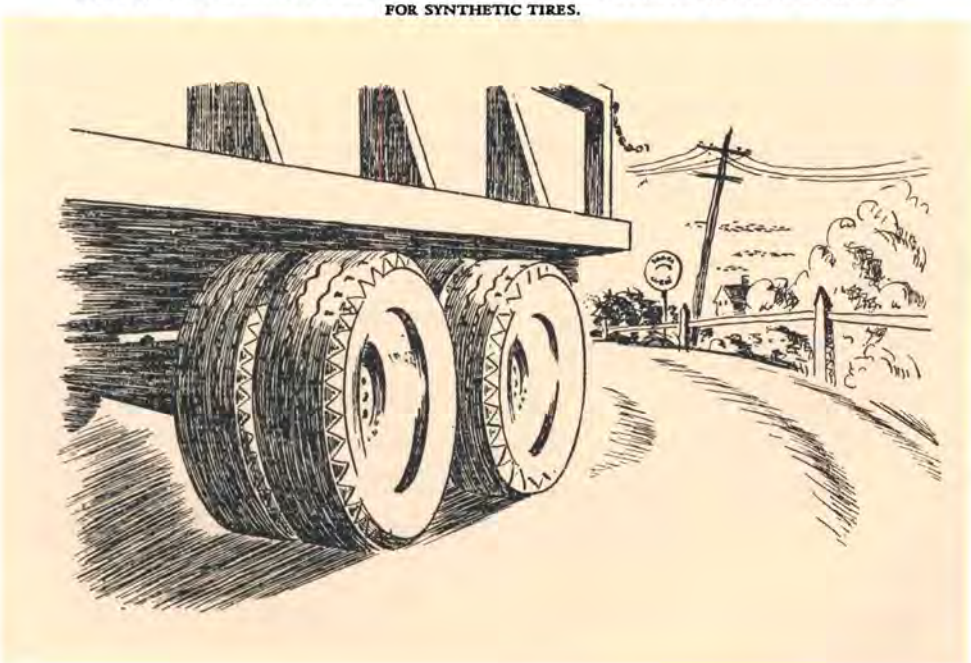
1.	New York	4,500 tons	113 mills
2.	Michigan	3,960 tons	56 mills
3.	Maine	3,350 tons	22 mills
4.	Wisconsin	3,270 tons	51 mills
5.	Ohio	3,110 tons	47 mills
6.	Pennsylvania	2,960 tons	57 mills
7.	New Jersey	2,400 tons	43 mills
8.	Louisiana	1,920 tons	8 mills
9.	Illinois	1,850 tons	25 mills
10.	Washington	1,790 tons	13 mills
11.	Massachusetts	1,680 tons	86 mills
12.	Virginia	1,650 tons	14 mills

Of course the values are not proportionate to the tonnage, for the mills that make the higher grades would secure larger prices for their product;

thus—Massachusetts, which stands eleventh in tonnage, would stand in the value of its production higher than some states that have much larger output.

Some years ago, a calculation of the publications of the United States revealed that New York had over 2,200; Illinois was second with about 1,850; while Pennsylvania, California, Texas, and Ohio came next in order with 1,157; 1,105; 925 and 913 respectively. France ranked fourth in the number of newspapers published. (Paris had, when I last secured the figures, one hundred forty-one daily papers, or more than London, New York, Philadelphia, and Boston together), but in the size of papers, and the number of copies printed, our publishers easily took the lead. Of course, the growth of publishing in America, and the changes effected in France and England by the war have altered these figures. One cannot know how many newspapers are now available to the sad people in Paris, but one can be sure that a Frenchman will now treasure his newspaper less for its content than for its

WOOD PULP IS THE ESSENTIAL RAW MATERIAL FOR THE MANUFACTURE OF RAYON CARCASSES FOR SYNTHETIC TIRES.



usefulness as a wrapping for the occasional carp that he may be able to buy.

The foregoing description of the making of paper does not pretend to be complete, as many details have been omitted for fear of making the story too long and tiresome, but has been written with the thought that some who handle paper may be interested in the method of its manufacture, and the problems that confront the paper maker.

Furthermore, this description does not take into account the circumstances created by the war, which are imposing appreciable responsibilities on the paper industry of the United States.

For one thing, the absorption of woodsmen into the military services has caused a shrinkage of major proportions in the production of pulpwood; and the production of paper is shrinking in consequence. Beyond that, the Army, the Navy, and the many governmental bureaus are consuming paper or shipping it to our Allies in enormous quantities.

The multiplicity of forms employed in conducting the transactions of federal bureaus and of the businesses that must account to them represent a sizable proportion of the production of the writing paper and carbon paper industries. Much of the production of the manufacturers of paperboard is required for the packing of ammunition, food, and supplies for our forces overseas. Labels for packaged foods, also military manuals and maps, are printed in great quantities on the products of book paper mills.

Yet these are but the obvious wartime uses of paper and pulp. There are many other uses that are less familiar, and a few of these are listed here.

Wood pulp in nitrated form is used as the firing charge for the big guns of the Navy and the Army. Wood pulp is the essential raw material for the manufacture of the rayon carcasses for synthetic tires for Army vehicles. Wood pulp is one of the raw materials required for the production of numerous of the plastics that are used for military purposes.

New papers and new qualities of paper have been created to fill military needs. Among them are:

Wrappings created especially to aid in preventing the rusting of guns, instruments, and precision parts that are shipped by sea to humid, tropical



MAP PAPERS THAT CAN BE USED IN THE RAIN, DROPPED IN THE SEA, AND USED REPEATEDLY IN SPITE OF FREQUENT SOAKINGS, HAVE BEEN DEVELOPED FOR OUR ARMY AND NAVY.

climes. The metals are coated with a thin film of oil which can prevent rust only so long as it remains an unbroken film on the metal. Ordinary wrappings act as wicks which draw the oil from the metal, but wrappings that do not wick have been devised, and arms are reaching the fighting fronts ready and suitable for use.

Map papers that can be used in the rain, that can be dropped in sea water, and that can be used again and again notwithstanding repeated soakings, have been created and are being supplied to the Army and Navy.

Map papers have been developed to glow in a light that is imperceptible except to the immediate observer. These allow military and naval commanders to chart their ways without disclosing their presence to a watchful enemy.

Paperboard boxes have been fabricated to protect their contents even

though immersed in the ocean. Capes made of pulp and of paper are available to protect soldiers from the serious skin burns caused by blistering war gases. Papers have been devised also for interleaving the tacky substances fabricated into protection coverings for aeroplanes.

Other new and unusual paper products include emergency stretchers, laminated fibre helmets and aviators' vests.

Under pressure of wartime conditions paper has also been adapted to many new civilian uses such as laminated paperboard hot-air ducts for domestic heating systems, creped wadding for insulation against heat and cold, gas- and flameproof papers, paper box springs, traffic signs, meteorological balloons, and substitute materials for rubber sheeting.

Because paper is adaptable to so many uses, and can be formed and molded into almost any shape, it is now replacing steel, aluminum, tin plate, rubber, silk, plastics, and other critical war materials.

Obviously, the combination of these extra military and civilian demands and the great production shrinkage caused by wartime conditions disrupts the relationships that normally exist between the paper-making industries and the civilian users of papers. It is our hope, however, that the period of restriction will be brief, and it is our conviction that it will be followed by an era of development and improvement that will raise the standards of paper making to new high levels.


The
Rochester Packet
Boat


FLYING CLOUD